OCTOBER • 1953

Economics & Cost
SYMPOSIUM

PETROLEUM REFINER

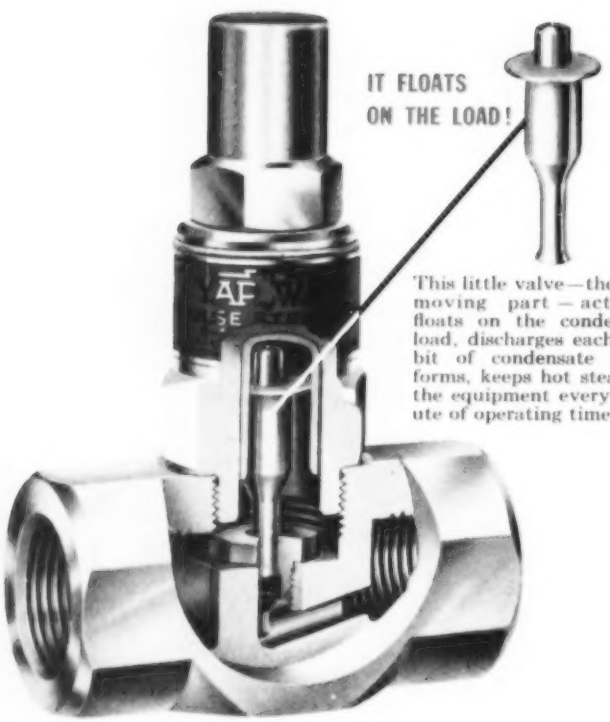
REFINING | NATURAL GASOLINE | PETROCHEMICALS

Round the world **SERVICE**

NATURAL GASOLINE
PROPANE
ISO-BUTANE
BUTANE
ISO-PENTANE
NORMAL PENTANE
HEXANE
HEPTANE
HEAVY NAPHTHA
STA-VOL-ENE

WARREN
PETROLEUM CORPORATION
TULSA, OKLAHOMA CABLE ADDRESSES: Stavolene, Warren
EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS

3000 impulses help keep mid-west refinery "on stream"



This little valve—the only moving part—actually floats on the condensate load, discharges each tiny bit of condensate as it forms, keeps hot steam in the equipment every minute of operating time.

THIS big refinery at Lawrenceville, Ill.—like a lot of other important refineries — uses Yarway Impulse Steam Traps.

Over 3000 Yarway Impulse Traps are installed on tracer lines and for draining steam headers.

Popular features of the Yarway Impulse Steam Trap are its ability to get equipment *hot in a hurry*—and keep it hot! . . . also its small, handy size—fits in easily in any location; its stainless steel body and working parts; quick installation; easy maintenance; low initial cost.

Another advantage — IMMEDIATE DELIVERY from 250 local distributors, plus quick service from nearby Yarway field engineers.

More than 900,000 Yarway Impulse Steam Traps have been sold. For a free Steam Trap Selector, write . . .

YARNALL-WARING COMPANY
128 Mermaid Ave., Philadelphia 18, Pa.

YARWAY impulse® steam trap

PETROLEUM
REFINER
REFINING | NATURAL GASOLINE | PETROCHEMICALS

Volume 32, No. 10 October, 1953

Symposium: Economics and Cost Estimating

Short Cut Estimating of Processes 97
J. F. Gilmore
Economic Analysis in Petroleum Refining 102
J. P. Hamilton
Economic Analysis in Chemical Plants 107
A. B. Horn, F. J. Sergeys and W. C. Strader
Definitive Cost Estimating 110
Harold Bottomley

OTHER TECHNICAL FEATURES

Compare These Four Methods for Making Phthalic Anhydride 113
Robert F. Ruthruff
Analyzing Process Control Systems 115
P. R. Hoyt and B. D. Stanton
New Research Center 120
Vapor-Liquid Equilibrium Ratios, Part I 121
J. M. Lenoir and G. A. White
Bay Refinery at Denver 124
Is Packed Height a Variable in Flooding? 125
Wm. Meese Newton, T. Brooks Metcalfe and J. W. Mason
Petrochemical Reactions, Part VI 129
Lewis F. Hatch
How to Specify Pumps 133
Melvin Mann
The Mechanical Design of Fluid Catalytic Hydroforming Units 135
R. A. Harang
New Processes Whip Waste Disposal Problem 139
Haviland F. Reves
Refining with Adsorbents, Part V 141
V. A. Kalichevsky and Kenneth A. Kobe
Physical Data on Hydrocarbons 145
Jack Sherman
New Automotive Laboratory Opened 150
Correlating Equilibrium Flash Vaporization Data, Part II 151
Edward H. Ten Eyck, Jr., and Donald F. Othmer
On the Spot Asphalt Quality Test 153
Robert E. Weaver and M. M. Gilkeson
Modern Grease Plant Goes on Stream 155
R. O. Rinearson and C. W. Nefsinger
Taking Stock 158
Cecil W. Smith

As Management Sees It

How Are Your Press Relations? 92
Al Reese
Investigate Your Fires to Prevent Recurrence! 232
Franklin G. Wilson
This Actually Happened 238
New Problems Arise in Iran 239
Robert E. Spann
The Courts Say 243
Joseph M. Shelton
The Problem of Alcoholism in Industry 244
Bryce B. Reeve

DEPARTMENTS

Quick Look 2-3
Look Box 89
Who's Building 95
Meet Our Authors 160
How to Do It 164
Who's Meeting 170
Calendar of Meetings 176
Reviewing New Books 177
Construction Boxscore 189
What's Happening 209
Information on Advertised Products 217
What's New in Manufacturers' Literature ..... Insert 216-217
What's New in Equipment 217
New Equipment Literature 228
What Suppliers Are Doing 251
Index to Advertisers 262

RAY L. DUDLEY, Publisher
A. L. BURNS, General Manager

DR. JOHN J. MCKETTA, JR., Editorial Director

ROBERT J. PHILLIPS, Editor
GEORGE B. GIBBS, Editor, Process and Construction
DON S. RAWLINGS, JR., Petrochemicals Editor
WM. G. DUDLEY, Equipment Editor
AL REESE, Editor, Special Assignments
CECIL W. SMITH, Economics Editor
ROBERT E. SPANN, Eastern and Foreign Editor
GILBERT M. WILSON, Western Editor
DR. LEWIS F. HATCH, Contributing Editor

SILAS B. RAGSDALE, Managing Editor
DAVID G. WILLIS, Editorial Assistant
LEVA A. MALCOLMSON, Librarian

Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
Box 2608, Houston (1), Texas

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline-petrochemical industry

WORLD OIL (formerly The Oil Weekly)
and The COMPOSITE CATALOG
for the drilling-producing-pipe line industry

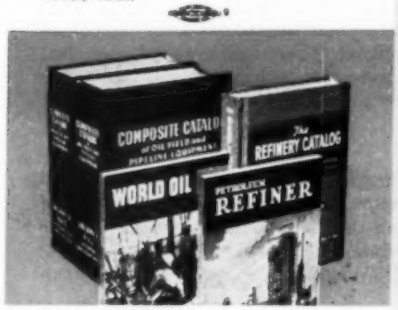
TOM W. NELSON, Advertising Manager

Advertising Representatives
GENE HART, GEORGE SKELTON,
250 Park Ave., New York 17, N. Y.
H. G. FITZPATRICK, MARTIN HALLORAN,
332 S. Michigan Ave., Chicago 4, Ill.
J. W. CURTS, W. W. Wilson Bldg.,
Huntington Park, Calif.
BILL WESTFALL, 1010 Euclid Ave., Cleveland 15, Ohio
BILL ATCHESON, Hunt Bldg., Tulsa 3, Okla.
CHARLES WYATT, CLAIR BRYAN, JR.,
3301 Buffalo Drive, Houston 19, Texas
D. S. CRAIG, Mgr. Advertising Service Dept.

Circulation Department
R. M. DE SOMBRE, Manager
Box 2608, Houston, Texas

Single copies 50 cents (except special issues) for U. S. and Canada; $1 for all other countries. Subscription rates—U. S. and Canada $2 a year; Latin America and overseas $5 a year. PETROLEUM REFINER, published on the 16th of every month, entered as second class matter June 16, 1923, at the post office at Houston, Texas, under act March 3, 1879. Advertising rates on application. Copyright 1953 by The Gulf Publishing Company.

Petroleum Refiner is indexed by Industrial Arts Index, Chemical Abstracts and by Engineering Index, Inc. Microfilm copies available through University Microfilms, Ann Arbor, Mich.



A Quick Look at

Petroleum Refiner this month

SYMPOSIUM: ECONOMICS AND COST ESTIMATING

There has been a conspicuous dearth of top-flight editorial material on the subjects of economics and cost estimating. This void in the technical literature has existed despite the energetic efforts of technical magazine editors throughout the industry to bring their readers valuable information on the heart and soul of the refining and petrochemical business.

PETROLEUM REFINER takes great pride in the unveiling of this Symposium—a notable exception to the past trends. The four articles in this symposium will reveal priceless facts and figures, methods and procedures on the basic foundation of the entire industry—economics and cost estimating.

—Short Cut Estimating of Processes. Page 97. All the data needed to prepare reasonable cost estimates of the more frequently purchased processes. Contains many hitherto unpublished figures and factors that simplify the job.

—Economic Analysis in Petroleum Refining. Page 102. Here are the answers, and the reasons back of them, on how to determine the dollar values of payouts on new installations, optimum operating methods, cost of new products.

—Economic Analysis in Chemical Plants. Page 107. An extremely helpful perspective of how the petrochemical industry conducts the financial side of their business, plus a liberal education in the engineering economics behind the development of new products.

—Definitive Cost Estimating. Page 110. The preceding article on estimating showed the way for the preparation of "horseback" or quickie estimates. In this paper, a logical followup, the author leads you through the complicated business of preparing a firm or definitive estimate or bid. Readers will profit from his shrewd analysis, based on impressive experience, of estimating pitfalls and dangers, subcontractors' items, prime contractors' profits, and others.

Compare These Four Methods for Making Phthalic Anhydride . . . How can phthalic anhydride be made commercially? The most important methods are presented here with a complete discussion of how they differ. Operating techniques, yields, and product purity are also fully covered for both fixed bed and fluidized catalyst operation. **Page 113.**

Analyzing Process Control Systems . . . Here is a practical application of the new engineering science of analyzing process control systems with the aim of improving response, stability, and efficiency. The authors applied the new technique to an extractive distillation unit, analyzed the test data graphically and mathematically, found the bugs in the system, and came up with the solutions to the problems. For a profitable half-hour, turn to **page 115.**

A Direct Method for Predicting Vapor-Liquid Equilibrium Ratios . . . Here is a method for predicting these data with high accuracy but without the tedious trial-and-error calculations. The method can be used for olefins as well as paraffins at pressures up to 10,000 psia. The effects of mixture composition on equilibrium ratios is simplified through the identification of mixtures by convergence pressures. This first part of a two-part paper deals with the general method and application to binary systems. **Page 121.**

Is Packed Height a Variable in Flooding? . . . Here, for the first time, are the data to prove that packed height is a variable. This variable has been neglected in the many studies. The authors point out that it would be wise to make correction for the packed height in generalized correlations. **Page 125.**

Nitration and Sulfonation of Paraffin and Aromatic Hydrocarbons . . . This is Part VI of the informative series, "Understanding the Chemistry of Petrochemical Reactions." For a clear, concise explanation of the many types of nitration and sulfonation reactions, read this interesting article. The general rules for nitrating hydrocarbons are also included. **Page 129.**

How to Select Pumps . . . Here is a manufacturer's eye-view of the really important factors involved in making a wise pump selection. Among the more important are: head-capacity requirements, complete description of fluid to be pumped, operational limits, and customer policy on first-cost versus maximum flexibility possibilities. These quickly-read, practical suggestions may save you real money and add to the performance of pumps slated for future purchase. **Page 133.**

The Mechanical Engineering Design of Fluid Hydroforming Units . . . The catalytic reforming of naphthas is of top interest to refiners throughout the world, and the latest commercial process is Fluid Hydroforming. Here is a keen engineering analysis of

the mechanical design features of the first commercial Fluid Hydroforming Unit. Process and design engineers, managers and operators, will profit from a careful study of this actual case history. **Page 135.**

Whip Waste Disposal Problems By These Methods . . . Imperial Oil Limited had a tough waste disposal problem with refinery effluent entering the St. Clair River only a short distance upstream of the intake point for Detroit's municipal water supply. Technicians took advantage of three recent developments to solve the problem: circular separators, biological oxidation, and flue gas distillation. For an absorbing and factual account, turn to **page 139.**

Refining With Adsorbents—Part V . . . This series is concluded with a comprehensive discussion of vapor-phase refining with adsorbents. This type of process is chiefly valuable for its ability to stabilize and desulfurize light petroleum fractions. Typical examples, complete with operating and analytical information, are discussed. Turn to **page 141.**

Physical Data on Hydrocarbons . . . Now available on punch cards are the data from API Project 44 on hydrocarbons and related compounds. These cards considerably enhance the use of these data, which include selected values of physical and thermodynamic properties for more than 935 compounds. **Page 145.**

Correlating Equilibrium Flash Vaporization Data . . . In the first paper of this two-part series the writers presented correlations of EFV data which could be used to obtain data at pressures other than experimental pressures. Here the correlation is presented in a simple alignment chart. You'll be surprised at the simplicity and the accuracy of this nomograph. Try it on your favorite hard problem today. **Page 151.**

On-the-Spot Asphalt Quality Test . . . Use this inexpensive method as a quality control indication to check asphalt topping units often and quickly. The test checks the standard ASTM penetration test to within plus or minus 5 percent. It can be run in a matter of minutes, whereas the penetration test requires almost an hour from the time the unit is sampled to the time the results are reported back to the unit. For details on this novel method worked out by the Tulane University Practice School, see **page 153.**

Modern Grease Plant Goes on Stream . . . Among the many novel features of this plant are: centralized control of operations, weighing of all ingredients used in grease making, hot oil heating and cold oil cooling of kettle equipment, pressure-vacuum contactors and kettles, and high capacity mill and dehydrator-deaerator. For a quick but complete visit to a modern, high-capacity grease plant, turn to **page 155.**

How Are Your PRESS Relations? . . . Newspaper oil editors say there is a lingering gulf between them and the public relations men. PETROLEUM REFINER asked some of the industry's experts how that gulf can be bridged. Turn to **page 92** for their replies.

Investigate Your Fires to Prevent Recurrence . . . Fire losses can be reduced if you will determine the cause of each fire; assess the total losses incurred; and count the lessons to be learned. Moreover, it isn't necessary to have a fire to learn a lesson in prevention, declares Franklin G. Wilson, director of API Safety and Fire Prevention Services. **Page 232.**

New Problems Arise in Iran . . . A realistic approach to the problem of Iran's re-entry into the world's oil markets must accept the fact that erstwhile consumers are no longer dependent on that nation's oil. Similarly, other oil producers must recognize that any substantial exportable production from Iran will have to enter the Western markets at the expense of production elsewhere. For an analysis of one of the industry's most critical problems, see **page 239.**

The Problem of Alcoholism in Industry . . . Here is a disease that costs 352 million industrial manhours per year. There are about 2 million problem drinkers in industry, and about 4 million in the nation. The yearly increase is about 250,000. What is to be done about it? "Bring it out in the open," says Dr. Bryce B. Reeve, director of the Medical department at Standard Oil Company (Indiana). "Recognition of the problem is as necessary with alcoholism as with polio, heart disease, and cancer," declares this authority. **Page 241.**

PETROCHEMICALS

IN A NUTSHELL . . .

- 55 process descriptions
- 55 flow diagrams
- 7 summation articles

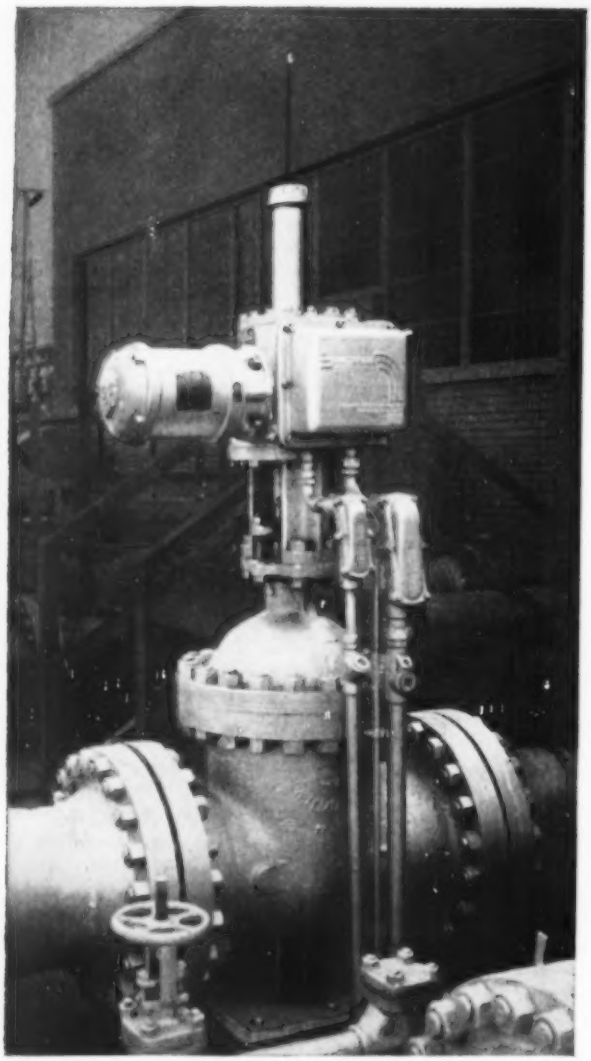
. . . in the PETROCHEMICAL PROCESS HANDBOOK

Coming up in November!

PETROLEUM REFINER

LIMITORQUE

The most widely used operator for REMOTE CONTROL of valves



In refineries and on pipelines all over the world, LimiTorque Valve Controls are giving dependable performance. They open and close valves of all types, quickly, safely, surely. With push buttons and indicating light panels, valves can be operated at remote locations while the status of the valves is always clearly known. Electricity, air or gas may be used for actuation. On many recent installations the high pressure gas in the lines has been utilized as a power source.

Your valve manufacturer can supply LimiTorque Controls.

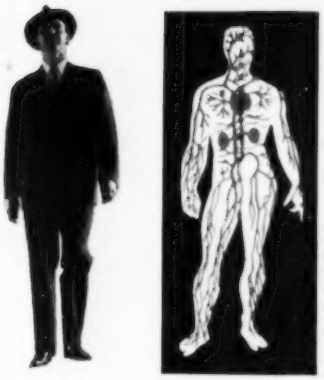
Write us for a copy of catalog L-50 or tell us your valve operating problem. Our engineers will gladly help you find a solution.

Philadelphia Gear Works, INC.

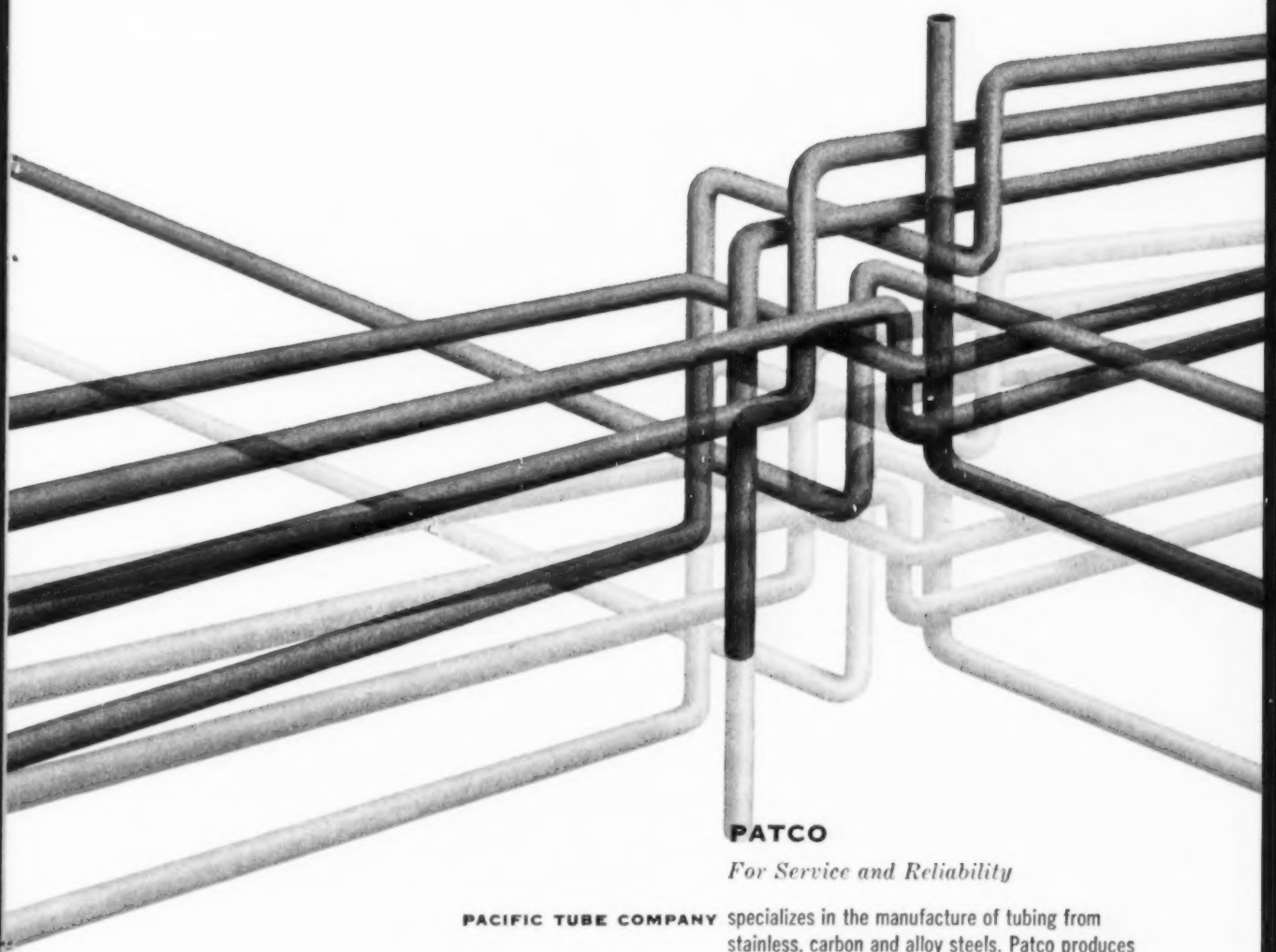
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK · PITTSBURGH · CHICAGO · HOUSTON · LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



THE LIFE BLOOD OF INDUSTRY FLOWS THROUGH STEEL TUBING!



PATCO

For Service and Reliability

PACIFIC TUBE COMPANY specializes in the manufacture of tubing from stainless, carbon and alloy steels. Patco produces cold drawn seamless tubing, welded tubing, and cold drawn bars. Write for our catalog.

PACIFIC TUBE COMPANY

5710 Smithway Street, Los Angeles, California

West Coast Representatives for Superior Tube Company, Norristown, Pa.

patco

ELIMINATES COST OF BORING OUT BAR STOCK!

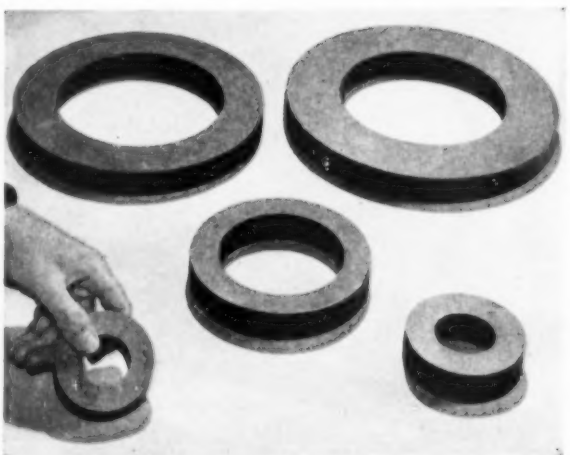
TIMKEN® heavy-wall steel pressure tubing is ready-made for today's higher operating temperatures

IF you need heavier-walled seamless tubing to withstand rising operating temperatures in your chemical plant, steam power plant or petroleum refinery, you can save money by getting Timken® heavy-wall steel pressure tubing. No need to bore out bar stock. With Timken heavy-wall steel pressure tubing the hole's already there. And wall thicknesses are available to withstand today's highest operating temperatures.

You get fine forged quality in Timken heavy-wall steel pressure tubing because the piercing process by which Timken seamless tubing is made is basically a forging operation. Timken steel tubing has a uniform spiral grain flow for greater strength, a refined grain structure which brings out the best in the quality of the metal. And this quality is uniform from bar to bar and heat to heat because of the Timken Company's rigid quality control from melt shop through final tube inspection.

Over 20 years of research and experience makes Timken Company metallurgists the recognized authorities on heavy-wall pressure tubing. They'll help you select—from 24 different analyses in sizes up to 10½" O.D.—the best size and analysis for your particular requirements.

Let our RSQ—Research, Supply, Quality—solve your tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Typical examples of Timken heavy-wall steel pressure tubing.

VISIT US AT THE I. P. E.

Be sure to see the Timken Steel Exhibit, at Booths No. 139, 140, 141, 142 in the Oklahoma Bldg. at the International Petroleum Exposition (May 14 to May 23).

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

Here Are Facts You Should Know About Electric Motor Bearings

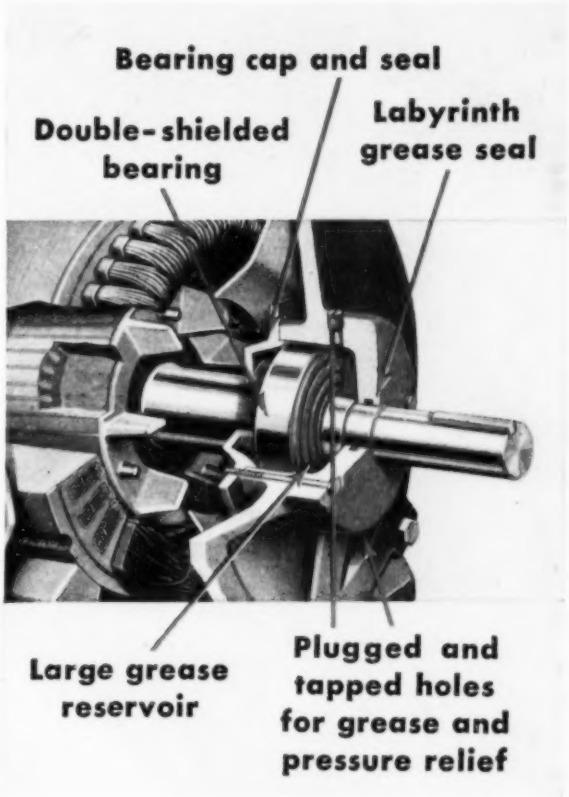
AN ideal motor bearing would operate for indefinitely long periods under all types of conditions without requiring any attention whatever. However, in the opinion of our engineers, such a bearing and its attendant lubricant are not yet available on the commercial market. Consequently, bearings for many types of operations, particularly where overloading, extreme temperature ranges and chemical and dirt laden atmospheres are involved, require special lubricants or regular lubrication schedules.

Of course, bearings suitable for many kinds of operation under normal conditions can be built to require no attention for very long periods — usually several years. Allis-Chalmers can supply sealed bearings in all frame sizes through 505 on short delivery and without extra cost for applications of this type.

Which is the Best Design for *Your* Application?

We believe that the design used in standard Allis-Chalmers drip-proof, tefc and explosion-proof motors represents the best design for most industrial users.

The Allis-Chalmers standard design consists of a pre-lubricated, double-shielded bearing mounted in the end housing with a generous grease reservoir. Plugged and tapped holes are provided for grease and for pressure relief. Under normal operating conditions, this design will operate as long without attention as any other type of bearing in use today. But where difficult operating conditions make re-lubrication desirable, it can be done as part of the normal lubricating routine without dismantling the motor.


Bearing cap and seal
Double-shielded bearing
Labyrinth grease seal
Large grease reservoir
Plugged and tapped holes for grease and pressure relief

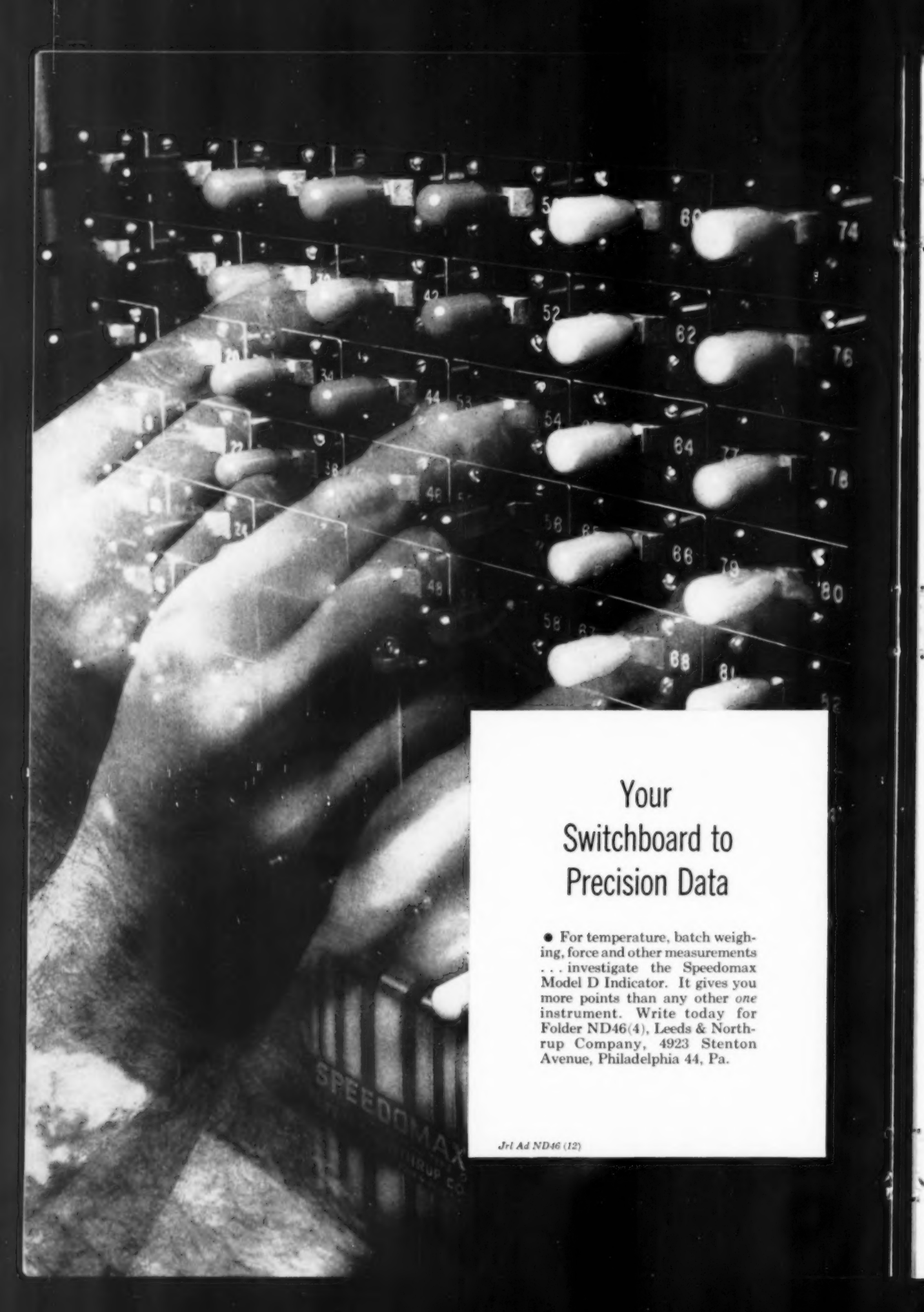
The large grease reservoir and shielded bearing design assure that grease lost from the bearing due to high operating temperatures or other causes will be replaced automatically.

For further information on bearing design and other features of Allis-Chalmers motors, call your nearby Allis-Chalmers District Office or Authorized Distributor.

A 4147

ALLIS-CHALMERS

Milwaukee 1, Wisconsin



Your Switchboard to Precision Data

● For temperature, batch weighing, force and other measurements . . . investigate the Speedomax Model D Indicator. It gives you more points than any other *one* instrument. Write today for Folder ND46(4), Leeds & Northrup Company, 4923 Stenton Avenue, Philadelphia 44, Pa.

Jrl Ad ND46 (12)

Eliminate the Danger of

INTERCRYSTALLINE CORROSION

ALLIS-CHALMERS
WATER CONDITIONING
Equipment — Chemicals — Service

Photomicrograph of edge of crack caused by intercrystalline corrosion. U. S. Bureau of Mines detection unit (inset) tests for causes of intercrystalline corrosion.

Dangerous and costly cracks due to intercrystalline corrosion (embrittlement) will be no problem in your boilers if you have given careful consideration to the problem *in advance*. You can get the information you need to analyze your operations from Allis-Chalmers water conditioning Bulletin 45. It explains intercrystalline corrosion — the cause of embrittlement. It tells what tests are necessary to recognize this condition. And it discusses what you can do.

Get the Answer to Many Problems

Bulletin 45 is one of a series of Allis-Chalmers bulletins on water conditioning problems. Like all of these useful bulletins, it is based on the wide experience of Allis-Chalmers water conditioning men in handling water problems for nearly every industry. In addition, it is based on Allis-Chalmers long experience building turbines and power plant equipment.

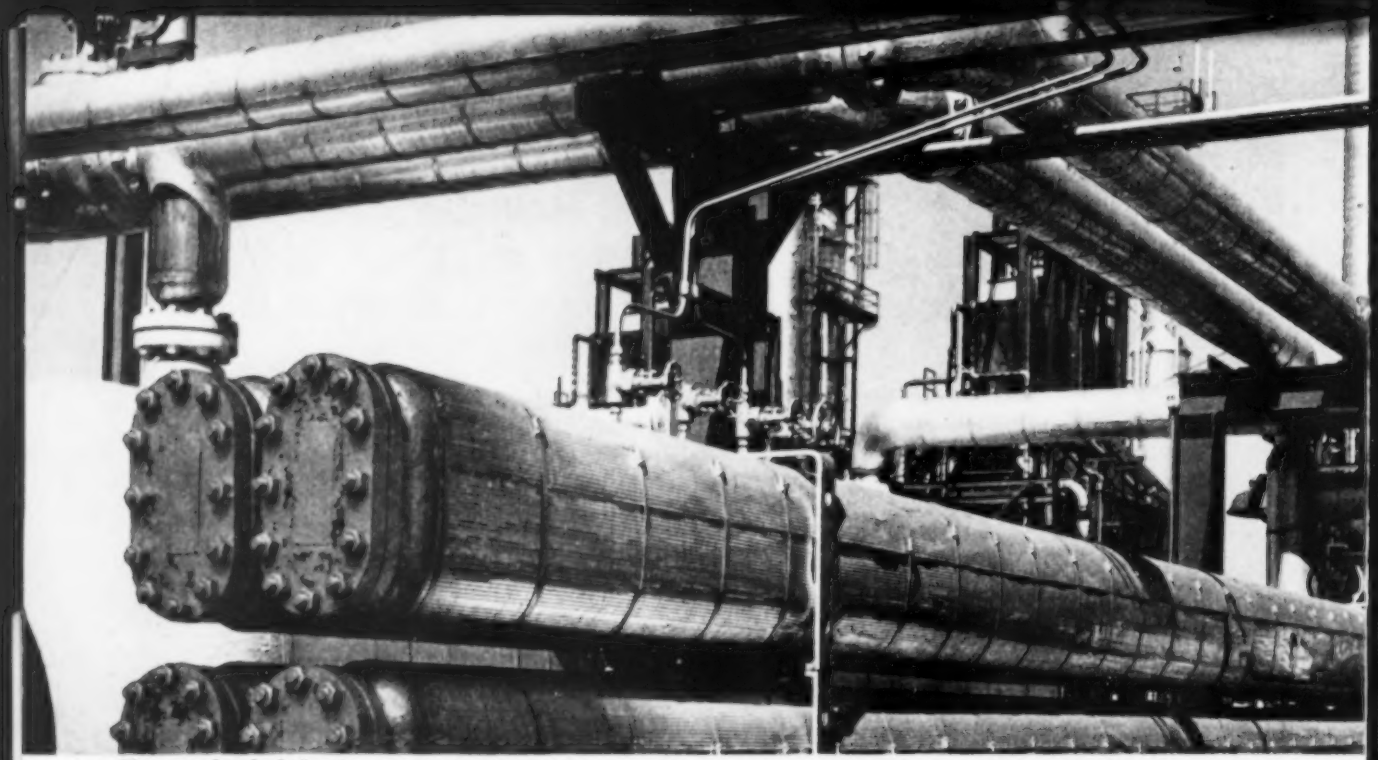
Complete Service Available

Allis-Chalmers gives you complete water conditioning service. You can get analyses and reports on your problems. You can get the chemicals needed in all water treatments. And you can get the equipment for any system.

A-4014

For your copy of Bulletin 45 on intercrystalline corrosion, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby Allis-Chalmers district office and have an Allis-Chalmers representative consult with you on your water problems.

ALLIS-CHALMERS



This new kind of aluminum jacketing is used in more and more outdoor processing plants to protect insulated towers, vessels, lines—it eliminates costly maintenance and replacement of old-fashioned coverings. Engineers report that Childers Jacketing has advantages not found in expensive heavy sheet aluminum, costs less to buy, far less to apply.

New Aluminum Jacketing Protects Insulated Lines...Cuts Costs 28%

How 986 of America's Leading Companies Saved Money By Weather-proofing Insulated Lines This New Way:

A two-man crew can apply the jacketing fastest. Only tools are a pair of pliers and a wedge or screw driver as shown here. Note how easily the jacketing forms around the pipe.

Aluminum strapping can be pulled plenty tight enough with just pliers like this. No special strapping tool needed. Strapping is pulled down between lugs and bent over.

Up-to-date appearance, low cost, and long life go hand in hand in a new aluminum jacketing for insulated lines. Developed by Childers Manufacturing Co., Houston, Texas, it is the first permanent weather-proofing that offers both low initial cost and low application cost.

Childers Jacketing, made of tough 3S aluminum alloy for maximum corrosion resistance, lasts years without painting or other maintenance. It costs less than even the cheapest kind of weather-proofing, when the cost of one paint job is considered. Savings run up to 28%.

Cost-minded engineers are also impressed with the gleaming beauty of Childers Jacketing that means "good plant housekeeping."

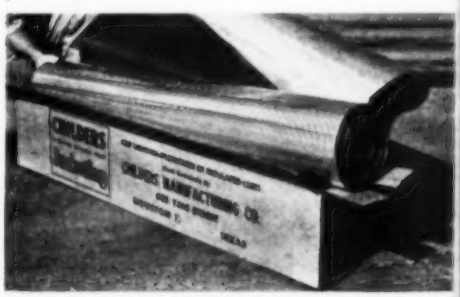
Available with moisture barrier attached, for use over 85% magnesia insulation.

5 years of tests and major installations in 986 of America's leading processing plants, refineries, and power plants have proven the advantages of Childers Aluminum Jacketing over other types.

Try this low-cost protection in your plant. Write today for engineering data and information about how you can order a 400 sq. ft. roll to test on one of your insulated lines. No obligation.

Address Childers Manufacturing Co., Dept. PR-16, 3620 W. 11th St., Houston 8, Texas.

Engineering representatives in all principal cities to work with you on your problems.



This is how the flexible, easy-to-handle Childers Jacketing arrives at the job site. It is in convenient rolls 4 feet wide and 100 feet long—just right for one man to handle—and is available either with or without a moisture barrier attached on the back of the .006" aluminum "skin." It can be cut to proper lengths using any flat table and a straight-edge. (Advertisement)

HELP NEW Cracking Methods

LEFT: Catalyst lift air blower supplies air at 13,320 cfm, 4.25 psig to raise regenerated catalyst to reactor. Kiln combustion air blower is seen to the rear.

ABOVE: Carbon is burned off the catalyst while air is supplied at 34,400 cfm, 3.5 psig by this kiln combustion air centrifugal blower.

As cracking methods improve, more centrifugal blowers are being employed. The Allis-Chalmers single stage blowers seen here are essential to the three new Thermofor Catalytic Cracking units installed by the Magnolia Petroleum Co. at Beaumont, Texas.

A total of six turbine-driven A-C single stage blowers provide kiln combustion and catalyst lift air in the blower room of the new catalytic structure.

The high efficiency impellers are of special totally enclosed, backward flow design. This covered design makes the impellers independent of tolerance variations; the backward flow design gives good pressure, volume and horsepower characteristics.

High strength and long life is assured by all-welded, alloy steel impeller construction and pressure lubricated sleeve and thrust bearings. Cast iron casing increases rigidity and decreases noise level.

For this kind of specialized design . . . or for standard high quality, thoroughly tested air and gas handling equipment . . . call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

A-3999

Texrope is an Allis-Chalmers trademark.

ALLIS-CHALMERS A-C

Power, Electrical, Processing Equipment for Petroleum Industry

TURBINE-GENERATORS | BLOWERS and COMPRESSORS | TRANS-FORMERS | UNIT SUBSTATIONS | MOTORS—*TEXROPE* DRIVES-CONTROL | CENTRIFUGAL PUMPS

Mail TODAY

YOUR BUSINESS DEPENDS ON PUMPS

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

CHECK BULLETINS YOU REQUIRE

☐ FIRE PROTECTION PUMPS BULLETIN B-1500 BULLETIN B-152
☐ TYPE PR REFINERY PUMP BULLETIN B-1605
☐ TYPE TU MULTI-STAGE PUMPS BULLETIN B-1400

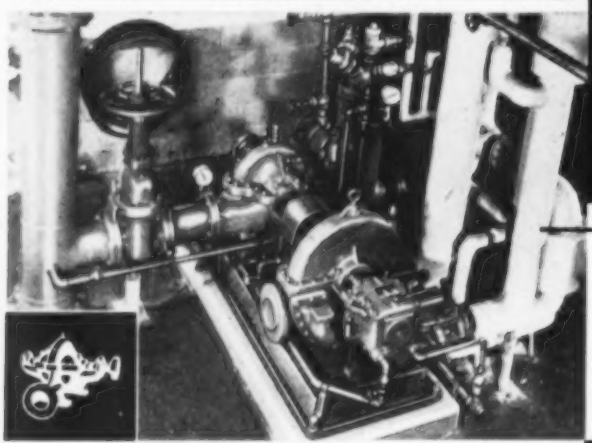
NAME_____

COMPANY_____

STREET_____

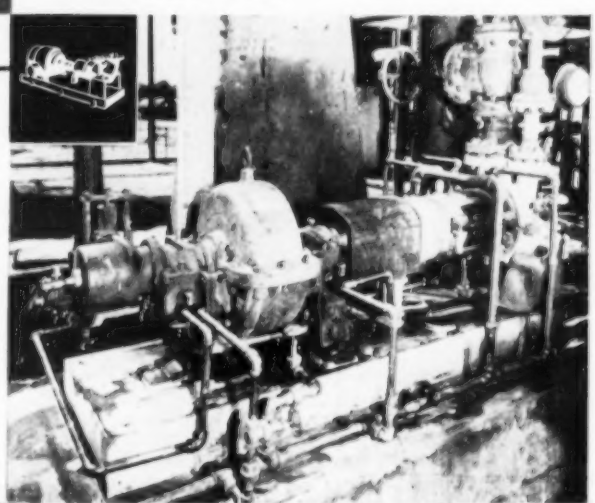
CITY_____ STATE_____

You can do a BETTER JOB with *Dependable* PEERLESS PUMPS



FIRE PROTECTION PUMPS—*A Peerless fire pump provides permanent and reliable fire protection for every commercial and industrial risk.* Peerless, with fully approved fire protection pumps, approved fire protection pump auxiliary equipment, and skilled fire protection pump application service offers unsurpassed protection against the hazards of fire. At the left is a typical Underwriters' approved Type AF Peerless horizontal fire pump, equipped with steam turbine drive. Widest range of approved ratings are available. Described in Bulletins B-1500 and B-152.

HEAVY DUTY CENTER-LINE MOUNT PUMPS—*The continuous transfer of crude charge stocks at high temperatures is handled by type PR pumps.* The Peerless line of packing gland construction and mechanical shaft seal construction pumps for handling hydrocarbons, chemical solutions and water at elevated temperatures and pressures is most complete. The pump in the view at the right is handling oil at 850° F. in an Oklahoma refinery. These refinery and chemical process pumps have a number of modern design features to recommend their installation. Fully described in Bulletin B-1605.



HORIZONTAL BOOSTER PUMPS—*Peerless multi-stage pumps for pumping hot or cold liquid in moderate capacities against medium and high heads.* Available in 2, 3, 4 and 5-stage designs for high head pumping. These Type TU pumps handle water and process liquids. Capacity range: to 3500 gpm; head range: to 1600 feet; hp range: to 350 hp. Pumps are of horizontal split-case design for easy maintenance. Quality construction throughout. The pump shown is operating on a cooling tower system. Request Peerless Bulletin B-1400 for complete Type TU pump details and description.

PEERLESS PUMPS

fmc

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, Calif. and Indianapolis, Indiana.
Offices: New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas; Plainview; and Lubbock, Texas; Albuquerque, New Mexico.
Distributors in Principal Cities; Consult your Telephone Directory.

FIG. B-268

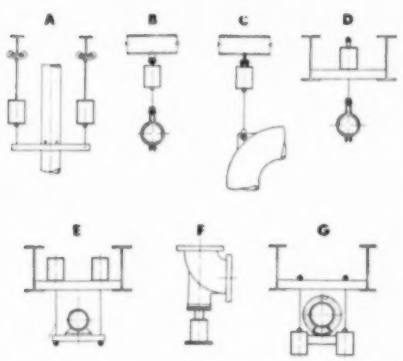
Pre-solve Pipe Suspension Problems...

with Grinnell Pre-engineered Spring Hangers

- Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes.
- Precompression* assures operation of spring within its proper working range where variation in supporting force is at a minimum.
- Compact—minimum headroom made possible by precompression*.
- Guides prevent contact of coils with casing wall or hanger rod and assure continuous alignment and concentric loading of spring.
- All-steel welded construction meets pressure piping code.
- 16 sizes available from stock — load range from 74 lbs. to 9000 lbs.
- Easy selection of proper sizes from simple capacity table.
- Installation is simplified by integral load scale and travel indicators.
- Unique swivel coupling provides adjustment and eliminates turnbuckle.

*Precompression is a patented feature.

TYPICAL APPLICATIONS

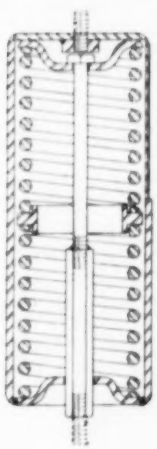


(A) Rod threaded to top cap (B) Furnished with single lug (C) Two lug style (D) Top adjusting (E) Adjustable top and bottom (F) For floor support (G) Trapeze assembly.

FOR LESS VARIATION IN SUPPORTING FORCE — FIG. 98

Fig. 98 is an adaptation of Grinnell's popular spring hanger, Fig. 268. It consists of two springs arranged in series within a single casing. A centering guide insures the permanent alignment of the spring assembly.

Fig. 98 has half the load deflection rate, and double the total working range of Fig. 268. Its 16 spring sizes accommodate loads from 74 lbs. to 9000 lbs. — but with a total working range *up to 5 inches!* Fig. 98 comes in the same seven types as shown for Fig. 268. Design details for identical types and sizes are the same for Fig. 98 and Fig. 268.

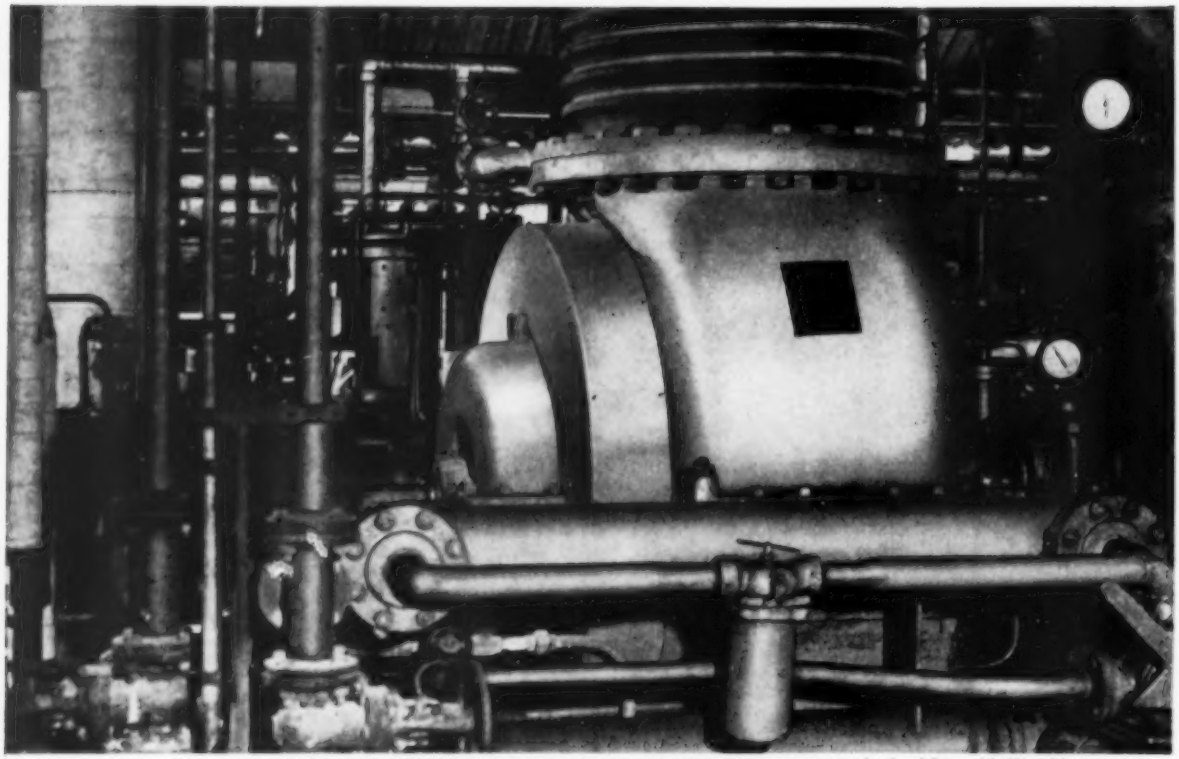


GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



LOW MAINTENANCE COSTS AND EXCELLENT STEAM ECONOMY are obtained from this Worthington high-speed turbine, one of two used to drive centrifugal blowers in this up-to-date refinery installation.

8000 rpm steam turbines operate on only 15 pounds inlet pressure

Worthington high-speed units at a Gulf Coast refinery drive centrifugal blower in cat cracker

• Steam at a pressure of 15 pounds is all it takes to power the two high-speed Worthington turbines that drive centrifugal compressors for the refining process in a cat cracker at a large Gulf Coast refinery.

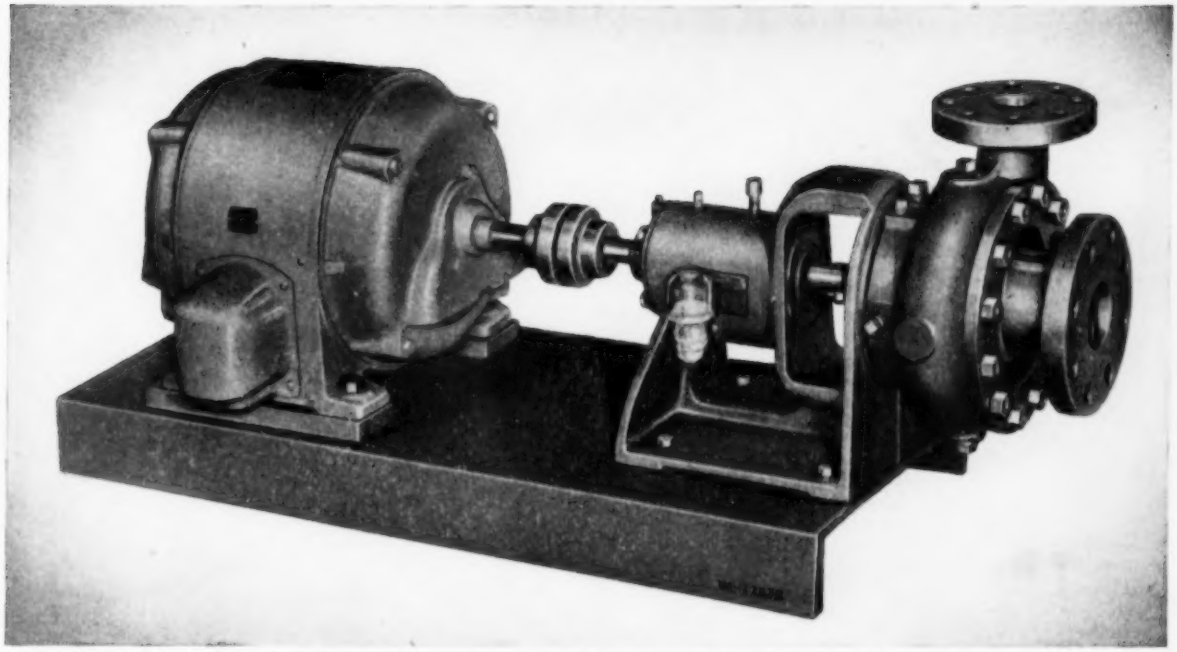
Worthington steam turbines are ideally suited for blower or centrifugal compressor drives, since they are built in all sizes and speeds for the most economical unit performance. There's no need for costly speed increasing gears, either, and the turbine's adaptability to various governing arrangements allows precise control under all operating conditions.

Remember, the engineering of the drive is just as important as the engineering of the compressor or blower. Worthington's long experience in compressor-drive engineering is your assurance of getting exactly the right type and size drive for your needs. Write today for Bulletin 1966 to Worthington Corporation, Steam Turbine Division, Wellsville, New York. T-3-5

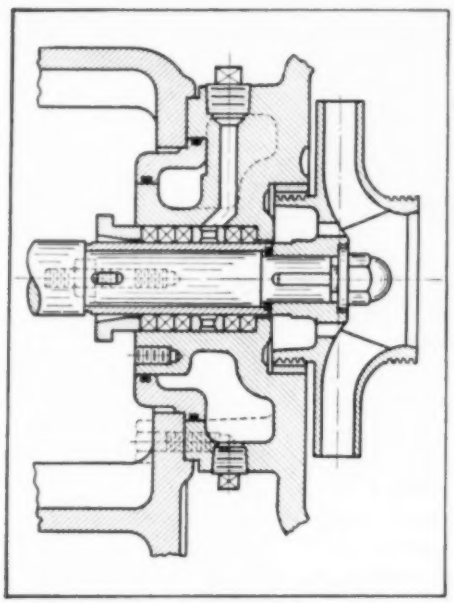
WORTHINGTON

A GREAT TEAM IN STEAM

Single-Stage Turbines • **Multi-Stage Turbines** • **Turbine-Generator Sets** • **Feed Water Heaters** • **Boiler Feed Pumps** • **Surface Condensers**



THE NEW WORTHINGTON TYPE CNR CENTRIFUGAL PUMP is designed to give dependable, trouble-free performance on a wide variety of refinery jobs.



WATER-COOLED STUFFING BOX provides longer life for packing and bearings. Cross-sectional view shows water-jacketing.

Here's another Worthington pump that makes refinery operations more efficient

It's our compact, single-stage Type CNR centrifugal pump, built to handle such refinery jobs as treating, blending, loading and transfer.

Here are some of the features of the modern CNR centrifugals:

1. HEAVY CASINGS in iron or steel for extra wear under high pressure and corrosive conditions.
2. WATER-COOLED STUFFING BOXES with conventional packing or mechanical seals optional.
3. HEAVY-DUTY CONSTRUCTION with 250-pound ASA flanges (150-pound in steel) for really rugged service.
4. INTERCHANGEABILITY. The CNR is part of our SESC pump line. That means complete interchangeability of any pump component for easier servicing, broader range of pump selection and greater availability.

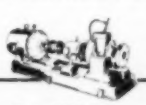
You can get the new CNR's in capacities up to 2700 gpm, to handle temperatures up to 350° F.

Write for Bulletin W341-B16 to Worthington Corporation, Centrifugal Pump Division, Harrison, New Jersey. C.3.9

Types HR and HB. Twenty sizes. Capacities up to 1,800 gpm. Developed heads up to 900 ft. Proper selection of material permits use for temperatures far below zero to 800 F. for pressures from high vacuum to 750 psig.

Type HD. Hydraulically-balanced double-suction impeller handles boiling liquids with low submergence. Capacities range from 600 to 3,200 gpm at heads up to 700 ft. To 850 F and 550 psig.

Type CNE. For loading or transfer service. Capacities to 2,700 gpm. Heads to 500 ft.

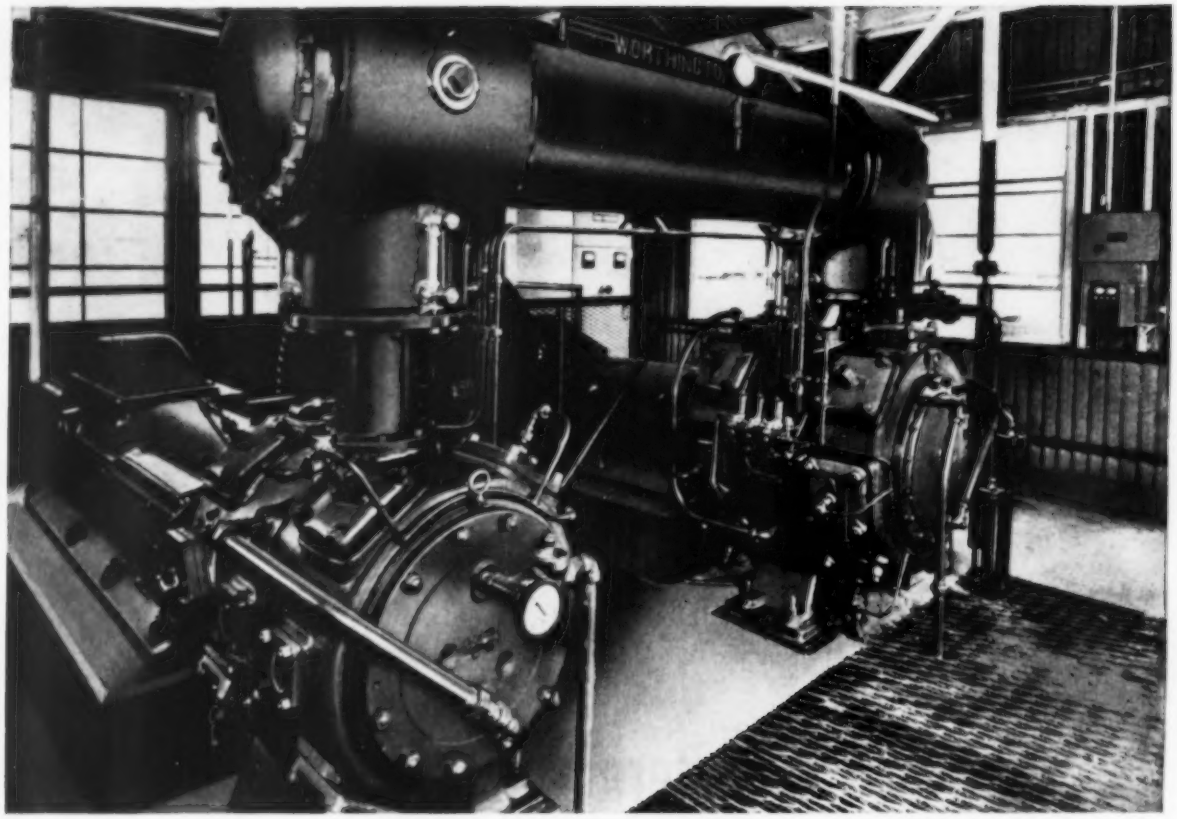


Type HM. Available in 12 sizes. Capacities to 700 gpm. Heads to 475 ft. Up to 500 F.

WORTHINGTON

Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job



WORTHINGTON DC-2 HORIZONTAL AIR COMPRESSOR, one of 14 Worthington compressors used for various services at the Girard Point, Pa., station of the Gulf Oil Company.

THIS COMPRESSOR KEEPS PACE WITH VARIABLE LOADS

Like compressors in industry everywhere, this installation at a large eastern refinery must face many variable load problems. Unless properly handled, variable compressor loads often result in wasted power and high running costs.

Worthington Five-Step Variable Capacity Control solves this problem.

The by-pass regulation—as achieved by suction valve unloaders and clearance pocket unloaders—is exclusively Worthington and offers these important advantages:

Economy of power—the air required at any moment determines the power used.

Simplicity—inlet valves and unloading mechanism form one individual element, easily accessible.

Low operating temperatures—a cooler cylinder insures improved lubrication and low oil consumption.

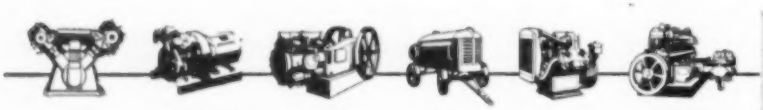
This Type DC-2 compressor is also equipped with the exclusive Worthington Feather* Valve—the lightest and most efficient compressor valve available.

Write for air compressor bulletin L-675-B1B to your nearest Worthington district office or to Worthington Corporation, Compressor Division, Buffalo, New York.

*Reg. U. S. Pat. Off.

A GLANCE AT THE INDICATOR PANEL of the Worthington five-step governor shows operating capacity at any moment.

K.2.13



No Other Compressor Will Outperform a Worthington

WORTHINGTON

Compressors

Are we going up or down?

Sometimes you can't be sure in a helicopter without referring to the instruments. Nor can you always be sure of your exact position in the gasoline market without checking all your "reference points." Your own sales figures are only half the picture. You have to know how the whole market is doing to really see where you are going.

Years ago, Ethyl realized that what the industry needed was a monthly report of gasoline sales in each area. Then each oil company could plot its own sales against the trend.

So in 1931 we set up a system for gathering and reporting this information—keeping each company's sales in strict confidence—but releasing the important over-all figures.

(Continued on next page)

ETHYL

Printed in U.S.A.

Are we going up or down?

(Continued from preceding page)

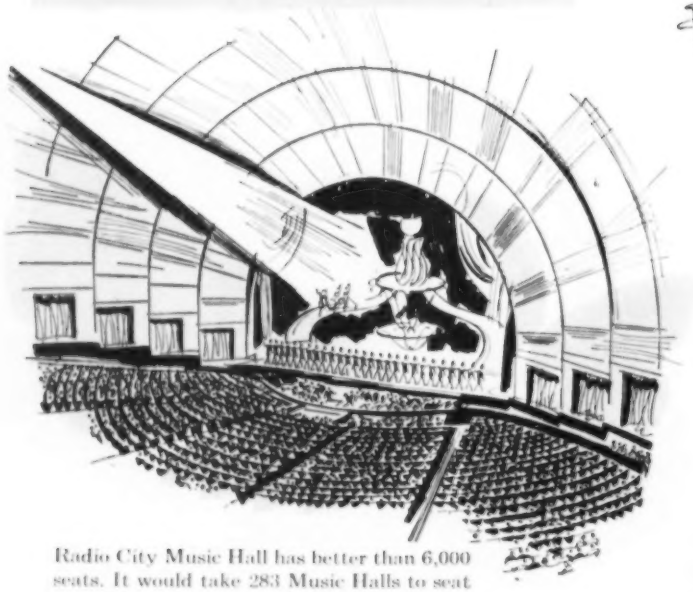
The market report your company gets is called the "Ethyl Monthly Report of Gasoline Sales." It shows sales of regular and premium gasoline for each state and the percentage of change from the same period of the previous year. Information as to aviation gasoline sales is tabulated separately.

The report covers 97% of all gasoline sold in the United States, and it's tailor-made for gasoline marketers—it excludes naphthas, diesel and jet fuels, and is based on actual sales figures.

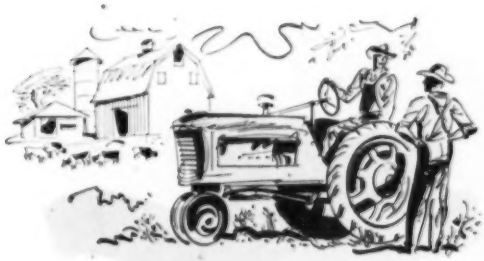
These monthly gasoline reports are an exclusive Ethyl service, which we're proud to perform for the petroleum industry.

ETHYL CORPORATION
NEW YORK 17, NEW YORK

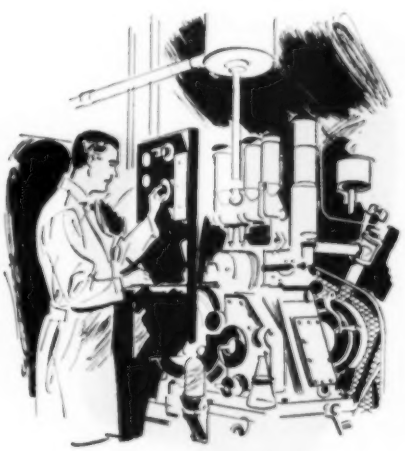
WORTH NOTING



Radio City Music Hall has better than 6,000 seats. It would take 283 Music Halls to seat all the people who saw Ethyl's educational films last year.

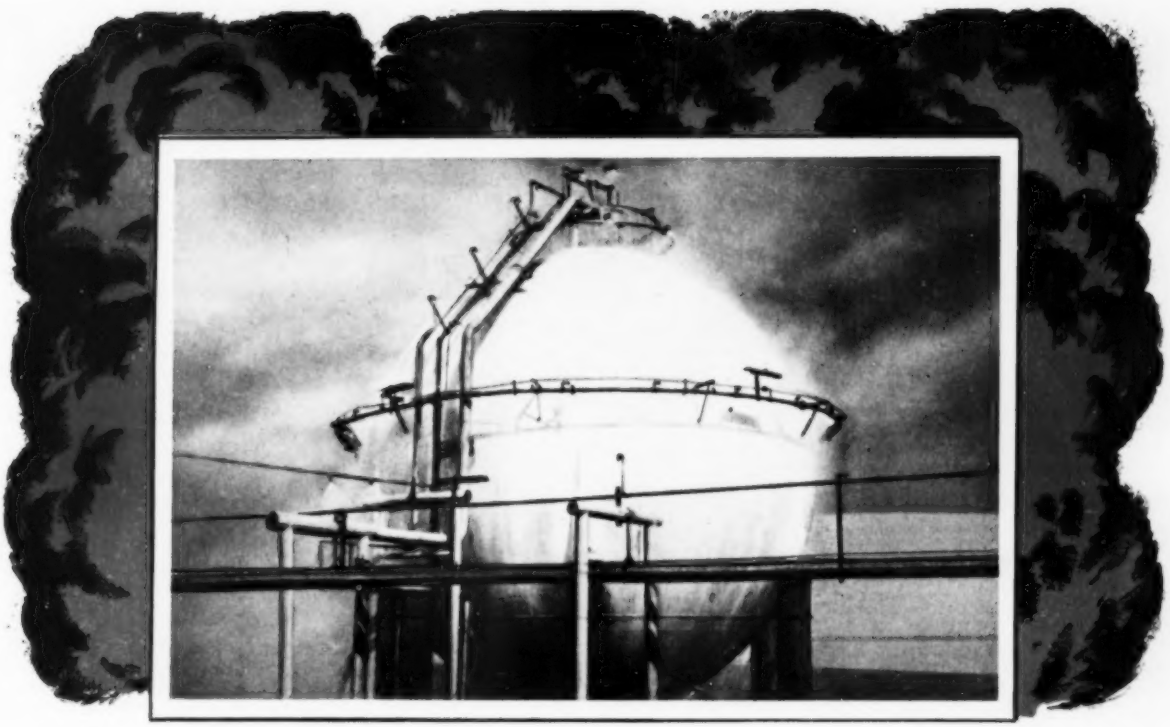


There were approximately one million tractors on farms in 1935 when the first high compression tractor—which Ethyl helped develop—was placed on the market. Today there are more than 4 times as many tractors! And this market alone accounts for some 3½ billion gallons of gasoline annually.



More than 15,000 gasoline samples are tested at Ethyl's five gasoline testing laboratories each year to furnish refiners with accurate gasoline quality reports.

Ethyl Service is backed by 30 years of antiknock experience

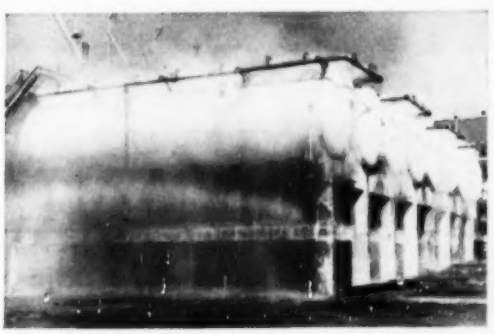


IT CAN'T HAPPEN HERE!

Protection of flammables calls for a system that goes to work the instant fire occurs . . . that's the reason so many tank farms and other hazardous properties are "covered" by

BLAW-KNOX Automatic FOG SYSTEMS

In the event of a critical temperature rise anywhere within the protected area, not a second is lost. A quenching deluge of water-fog smothers the hot spot at once. Other nozzles go into action to cool off adjacent tanks, and alarms are sounded instantaneously. To get the most effective fire protection ask a Blaw-Knox engineer to make a survey of your property and submit an estimate . . . There is no obligation.



Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems with new improved Spray Heads, Foam and Carbon Dioxide Extinguishing Systems . . . listed by Underwriters Laboratories, Inc. and approved by Factory Mutual Laboratories.

"Little Joey Sprinkler"
Always on the Job

BLAW-KNOX COMPANY
AUTOMATIC SPRINKLER DEPARTMENT
Pittsburgh 33, Pa.
CEdar 1-0700

BLAW-KNOX

COMPRESSOR CONTROL PROBLEMS?

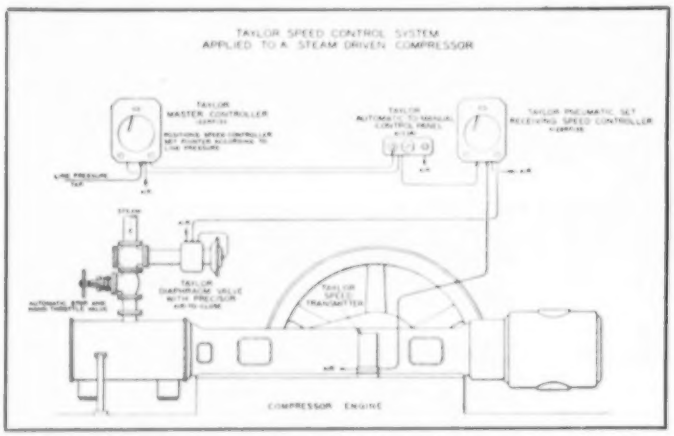
Taylor Speed Control gives better operating economy and processing quality for any type compressor or driver

Taylor Compressor Control Systems combine speed control to give you fully automatic control of compressors with direct relation to other variables in your process. These compressor control systems were developed by Taylor Engineers working hand in hand for years with leading compressor manufacturers and the ultimate user in refineries, gasoline plants and petro-chemical plants.

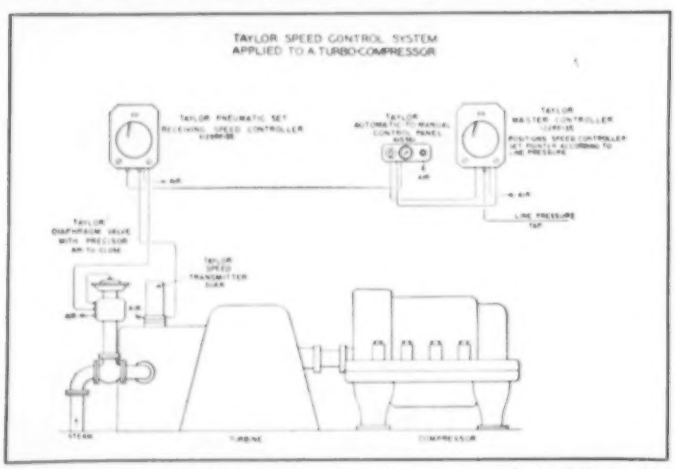
This all adds up to one important point. *When a compressor's function is closely controlled according to process requirements, substantial economies result from reduced fuel consumption as well as higher yields of quality end product.*

We can furnish a rugged, dependable control system for any type of driver and compressor combination. Ask your Taylor Field Engineer! Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

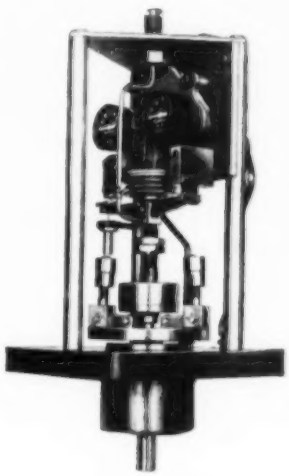
Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.


TAYLOR SPEED CONTROL SYSTEM
APPLIED TO A STEAM DRIVEN COMPRESSOR
TAYLOR MASTER CONTROLLER
TAYLOR AUTOMATIC TO MANUAL CONTROL PANEL
TAYLOR PNEUMATIC SET RECEIVING SPEED CONTROLLER
LINE PRESSURE TAP
STEAM
TAYLOR DIAPHRAGM VALVE WITH PRECISION AIR TO CLOSE
TAYLOR SPEED TRANSMITTER
COMPRESSOR ENGINE

On this Reciprocating Compressor Speed Transmitter teams up with Taylor Pressure Controller, Pneumatic Set Speed Controller and Diaphragm Valve to maintain desired process pressure at minimum operating cost.



Applied to a Centrifugal Compressor equal benefits are derived from this control system. Fuel consumption is held to a minimum, consistent with the maintenance of optimum process pressure.



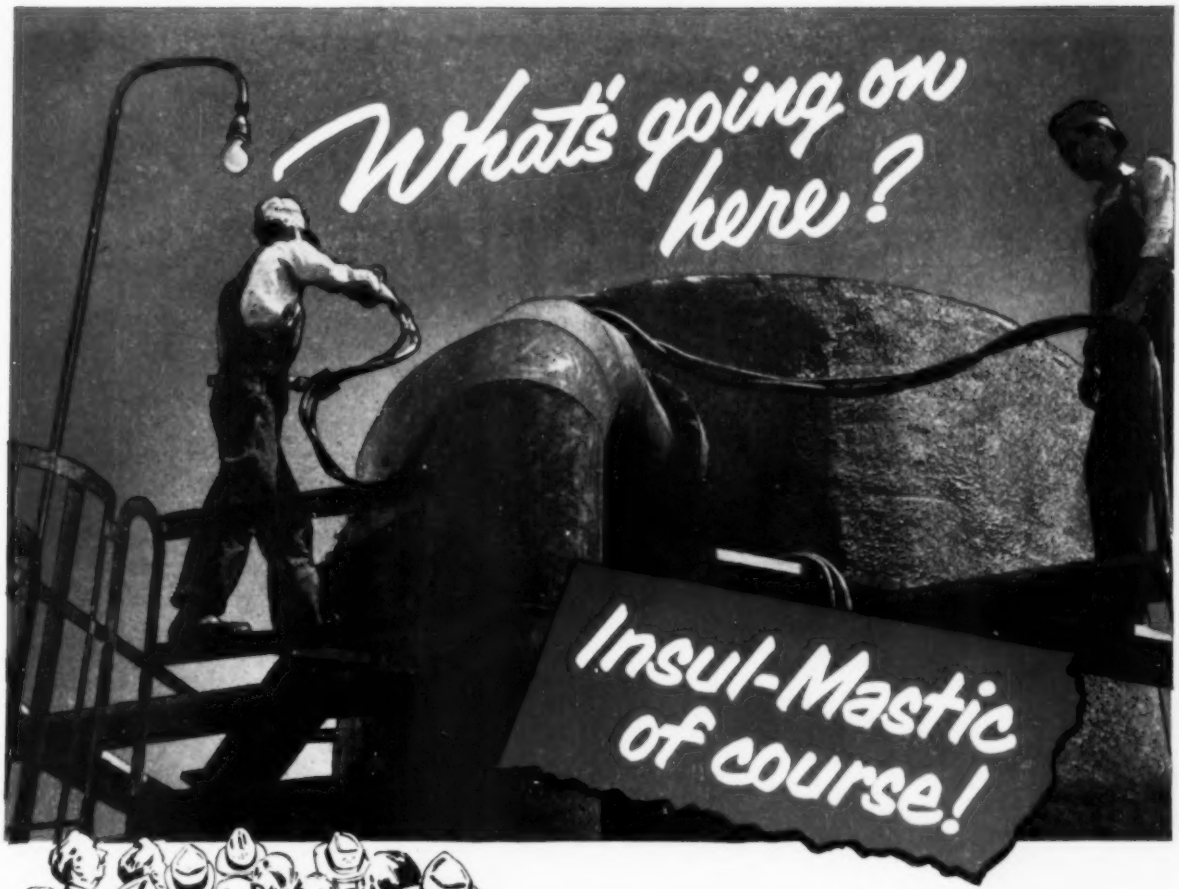
Taylor Speed Transmitter permits use of standard controls!

Here's how it works:

It is a dependable force-balance transmitter working in combination with a Taylor FULSCOPE* pneumatic controller. The fly-ball operated transmitter is driven by the compressor and converts engine speed directly to output air pressure proportional to the square of the speed. This signal is received by a Pneumatic-Set FULSCOPE Controller which regulates the fuel valve to give desired speed control. Processing pressure requirements—measured and controlled by the master controller—determine the speed controller set point.

*Reg. U. S. Pat. Off.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST



It's going on over thermal insulation as a vapor and weather barrier

Here's how to keep absorbent insulation dry on fractionation towers, "cat" crackers, tanks and other vessels. First press membraning cloth into a light coat of INSUL-MASTIC, which has been sprayed over the insulation. Then spray with a heavy coat of INSUL-MASTIC. That ends the insulation worries for years to come. The insulation stays dry and efficient beneath its INSUL-MASTIC coat. And while it's dry your metal equipment can't rust beneath its insulation.

This *Superior* coating gives lasting protection because of its flexibility and its tough fillers, like asbestos, which absorbs physical abuse, and mica, which reflects harmful rays of the sun. Its large Gilsonite content resists industrial fumes and vapors. Weather won't harm INSUL-MASTIC. It will stand 40° F. below zero or 300° F. above. As for being watertight . . . its moisture vapor transmission rate is only .01 grams per 100 square inches per 24 hours per ⅛ inch.

Specify this *Superior* coating for your thermal insulation or to prevent corrosion. Write for our catalog and the name of the INSUL-MASTIC Representative near you.

Think First of the Coatings that Last!

Where less insulation is needed use INSUL-MASTIC TYPE "D". One coat over metal insulates and also prevents corrosion.

Insul-Mastic

CORPORATION OF AMERICA

Oliver Building • Pittsburgh 22, Pa.

Representatives in Principal Cities

Which of these BASIC MATERIALS will solve *your* processing problems?

Norton electric furnace products are engineered and prescribed to meet many manufacturing needs

Backed by over 50 years of experience in electrochemical refining, Norton brings you basic materials whose purity and properties are carefully controlled and consistently duplicated.

These Norton electric furnace products differ greatly in composition and characteristics. They are the source of the many Norton *engineered prescriptions* which have proved of immense practical value in widely varying processes.

Moreover, each of them has possibilities for use which are still undiscovered. It will pay you, therefore, to read the following descriptions very carefully. Even this partial list may contain the exact combinations of properties *you* need.

ALUMINUM OXIDE (ALUNDUM®)

Norton is the world's largest producer of this basic material — fused alumina. *Characteristics:* high melting point, about 3700°F; specific gravity, 3.95; good chemical stability, neutral to most chemical reagents; extreme hardness of 2000 Knoop, with great toughness; reasonably high thermal conductivity, 2½ times that of fire clay; high dielectric strength. *Uses:* heavy refractory furnace shapes; pure oxide and sintered refractories; radio tube insulation; porous media for filtration and diffusion; catalyst carriers and fluid catalysts; heat exchange pebbles; wear-resistant parts; laboratory ware.

SILICON CARBIDE (CRYSTOLON®)

Silicon carbide is produced by Norton in large tonnages. *Characteristics:* high melting point, disassociates at about 4175°F; specific gravity, 3.20; extreme hardness of 2500 Knoop, with excellent abrasion and erosion resistance; high thermal conductivity, 7 to 10 times that of fire clay; excellent resistance to thermal shock; maintains great strength to very high temperatures (PCE, 3350°F — cone 37 to 40); unique electrical qualities; relatively low thermal expansion; no inversion on heating; chemically acidic, with good stability. *Uses:* special refractories for boiler furnaces, ceramic kiln furniture, heat treating, hearth plates, high thermal conductivity muffles and retorts; electrical heating elements; lightning arrestors; metallurgical additions; also available in a Norton-patented process for coating graphite — in rocket nozzles and reaction motor parts, etc. — for increased resistance to erosion by high velocity gases.

MAGNESIUM OXIDE (MAGNORITE®)

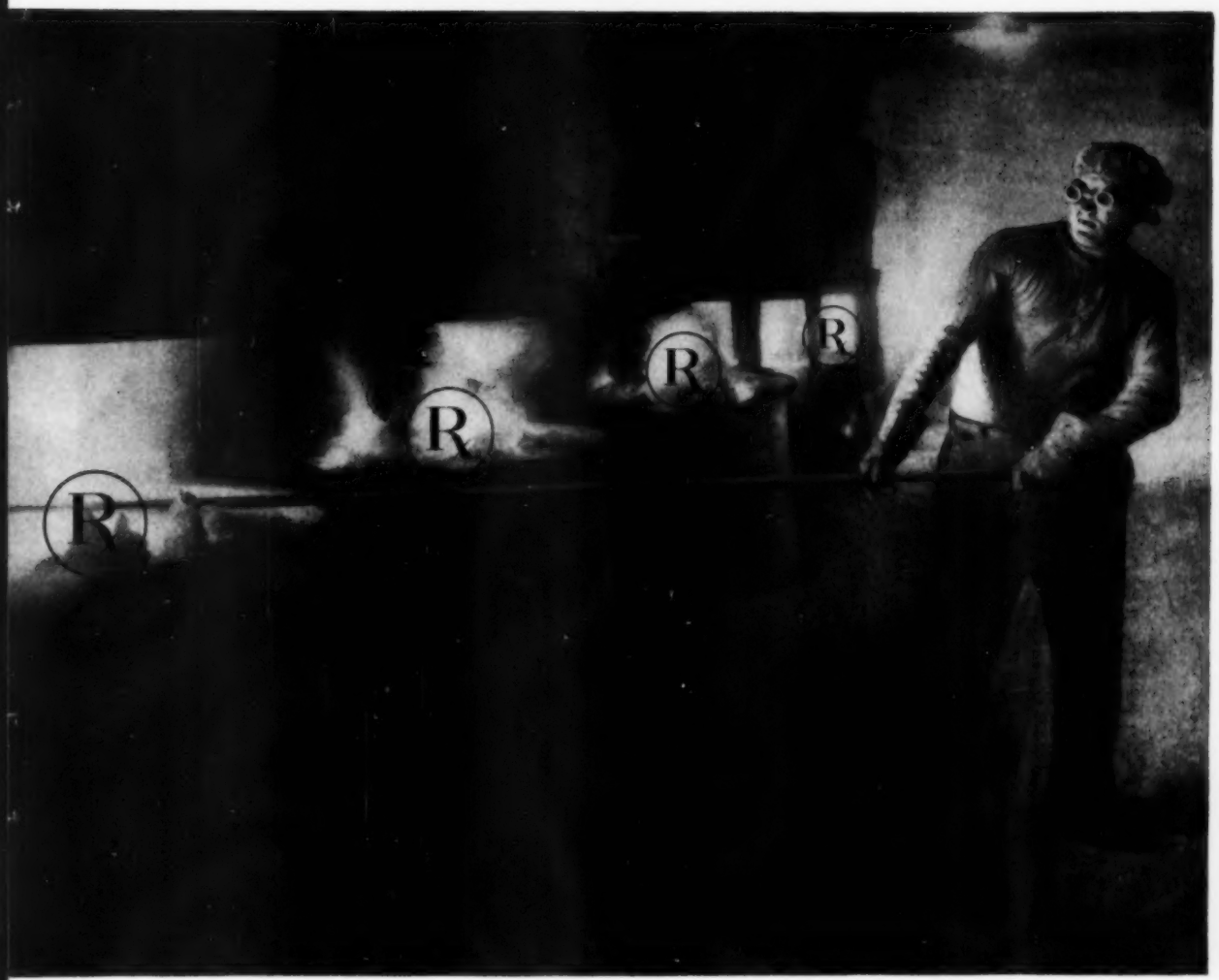
Fused magnesia of highest purity. *Characteristics:* extremely high melting point, about 5,000°F; specific gravity, 3.58; electrical resistivity, 10^8 ohm cm at 1000°C; chemically basic. *Uses:* linings for metal melting furnaces; high temperature electrical insulation; refractories for handling corrosive caustic materials.

FUSED STABILIZED ZIRCONIA

Norton was the first to develop fused zirconia for practical commercial use. *Characteristics:* high melting point; thermal conductivity in British Units at 2000°F is 6.2 for dense shapes, 4.7 for insulating shapes, 2.8 for insulating grain; high resistance to abrasion and thermal shock; not wet by most molten metals; changes from a fairly good electrical insulator at low temperature to a conductor at 1000°C. *Uses:* refractories for extremely high temperatures; setter plates for titanates; furnace linings for high temperature gaseous chemical reactions; zirconium chemicals; metal melting furnace linings; catalyst carriers; heat exchange pebbles; reaction engine parts including jet and rocket liners.

BORON CARBIDE (NORBIDE®)

The hardest man-made material, an exclusive Norton development of boron carbide. *Characteristics:* high melting point, 4440°F; specific gravity, 2.50; compressive strength, 414,000 psi; bending strength, 44,000 psi; self-bonding, unaffected by all acid and alkali solutions. *Uses:* abrasive for economical replacement of diamond dust in lapping; high purity powder of micron sizings for use as refractory and in "cermet" combinations; neutron absorption in nuclear reactors or particle accelerators; pressure-blast nozzles; wearproof bushings, slides, etc.



In these Higgins type arc furnaces tremendous amounts of electrical energy are utilized by Norton in electrochemically refining crude minerals into basic & refractory materials.

BORON NITRIDE

Refined by Norton to over 98% purity. *Characteristics:* melts or dissassociates at 5400°F; a nonconductor of electricity; weighs only 7 lbs. per cu. ft.; is not oxidized in air at 1200°F. *Uses:* anti-sticking agent for use with molten glass or metal; heat-resistant lubricant; thermal insulator in vacuum or atmosphere furnaces; experimental refractory or crucible material; experimental electrical insulator.

MANY OTHER MATERIALS

Among the high-melting, useful materials made available by Norton are Special Fused Oxides, Refractory Carbides, Refractory Borides, Mixed Borides, Elemental Boron. Research, development and field testing are being conducted on Experimental Borides, Carbides, Nitrides and Silicides. Some of these are in regular industrial use and new uses are being found for others.

AVAILABLE IN MANY STANDARD OR SPECIAL FORMS

Besides supplying these materials in their crude form, more or less as they come from the furnace, Norton has extensive facilities for processing and fabricating — and is ready to work with you in engineering any of these materials to your particular requirements.

GET THIS BASIC MATERIALS BOOKLET

This new Norton Publication, "Basic Materials," contains 22 pages of detailed information, including actual and suggested uses. For your copy, write to NORTON COMPANY, 469 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

NORTON

R REFRACTORIES

Making better products . . . to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

... in the field—

EMPLOYEES ARE HAPPIER...

with a WHITMOR Distinctive Field Home!

When a man comes home from work, there's a great feeling of pride as he says to himself "This is my home"! He likes to see his family happy and contented. The modern-minded oil company has learned that field employees must have this satisfied feeling in order to do good work . . . that's where WHITMOR comes in! Distinctive WHITMOR field homes build company morale and satisfied field employees — this means higher-calibre work at important field installations. Yes, it is the wise company who invests in employee satisfaction.

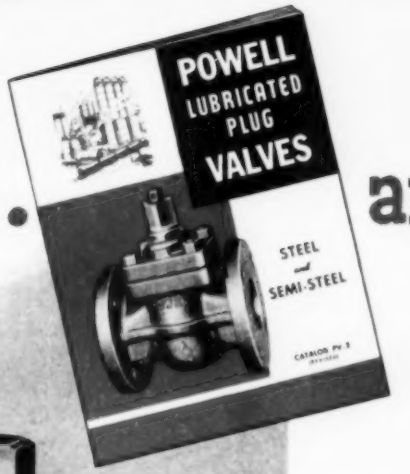
You can depend on Whitmor's 33 years experience to give you the best employee homes in the field. Send for Whitmor's illustrated information folder that gives you all the facts about Whitmor Homes and the popular Lease-Rental Plan.

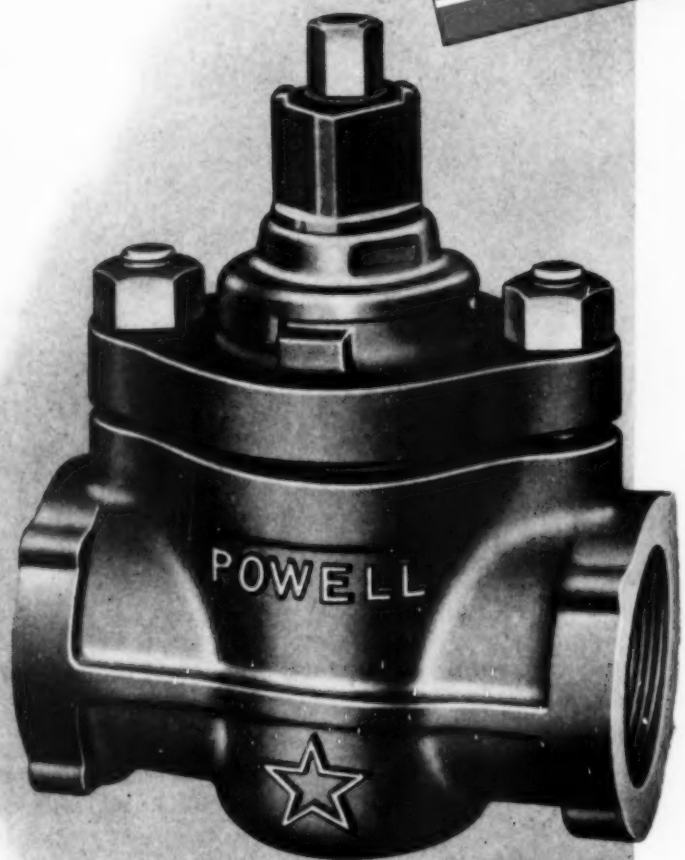
WHITMOR HOMEBUILDERS INC.

INDUSTRIAL HOUSING | THE FINEST IN THE FIELD

5525 EAST 15TH STREET • BOX 5037—TULSA, OKLAHOMA • PHONE 6-1137

New... and too good to miss!





Now, for the first time, lubricated plug valves that carry the Powell name and measure up to the Powell standards of precision are available in Semi-Steel and Carbon Steel.

You'll want the new PV-2 Catalog in your files. In fact, no valve file can be considered complete without it. And it's so easy to get. Just fill out the coupon below and mail. No charge, no obligation.

As you page through the catalog, you'll see the details that maintain these great new valves in the century-young Powell tradition. Features include quick and positive operation—just a quarter-turn of the Lubricated Tapered Plug to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed.

Powell Lubricated Plug Valves are available with Screwed or Bolted Glands. Semi-Steel Valves are available for 175 and 200 pounds W.O.G. Carbon Steel Valves are available for 150 and 300 pounds W.P.

Powell Valves

THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO

Free! SEND FOR THE PV-2 CATALOG TODAY

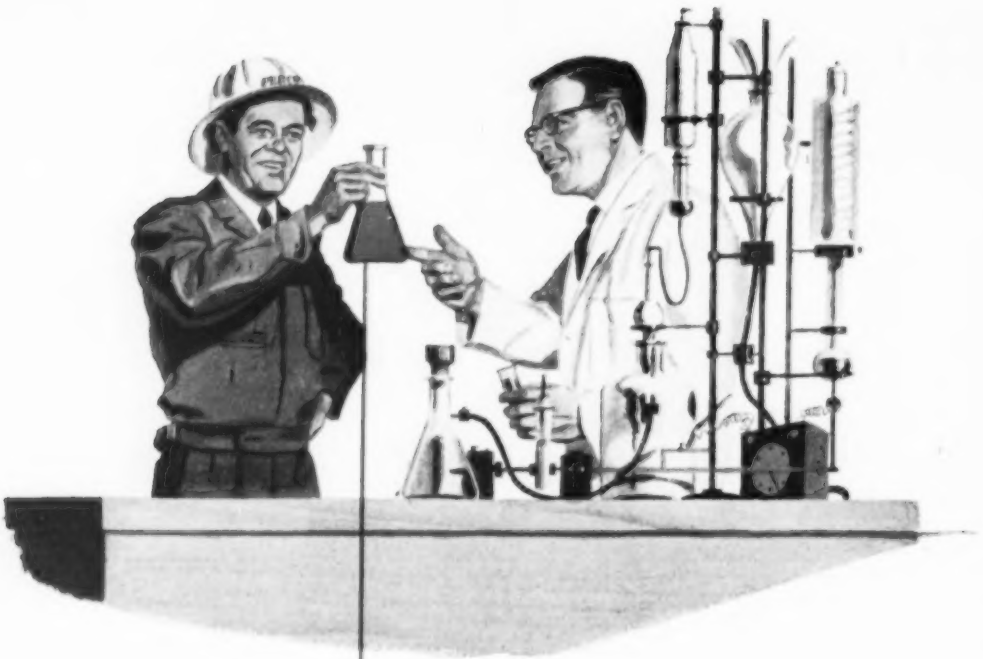
... it's too good to miss!

THE WM. POWELL COMPANY
2503 SPRING GROVE AVE., CINCINNATI 22, OHIO
Gentlemen:
I want to bring my valve file up to date. Please send me a copy of your PV-2 Catalog on Powell Lubricated Plug Valves.

NAME_____ TITLE_____

COMPANY_____

CITY_____ ZONE_____ STATE_____



improve YOUR products with

PERCO*

How will your products stand up against competition one, two or three years down the road?

After analyzing that problem, a good many refiners have found the answer in a Perco process. At a reasonable investment cost per barrel of charge and remarkably low operating expense, Perco enables you to upgrade your products in line with the current and anticipated market demands.

When you are considering a Perco process, arrangements can be made to evaluate samples of your present or proposed feed streams under actual operating conditions in Perco pilot plants.

over 130 installations licensed by Perco throughout the United States, Canada and Latin America prove the wide application of Perco processes to current refining problems.

Now is the time to upgrade your throughput.

Write Perco today for full information.

PERCO
Division

Phillips 66

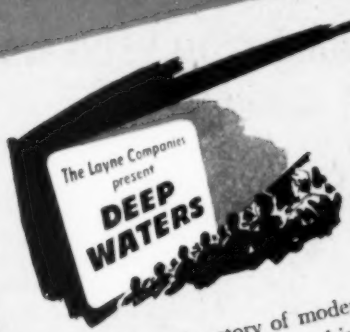
PHILLIPS PETROLEUM COMPANY

PERCO®
*A SERVICE MARK

Bartlesville, Oklahoma

See this new color movie on modern water development

Interesting! Educational! Helpful!



ARRANGE FOR A SHOWING TO YOUR GROUP

The fascinating story of modern water development is unfolded before your eyes in this new 22-minute sound movie in color. Filled with dramatic action shots, "DEEP WATERS" is just as interesting to experienced water works men as it is to people who want to keep informed on engineering advances affecting our cities and industries.

LAYNE & BOWLER, INC., Memphis 8, Tenn.

THERE'S NO CHARGE FOR SHOWINGS BY

- Municipal officials and planning boards
- Industrial groups
- Technical schools and colleges
- Government agencies and departments
- Technical societies
- Service clubs and civic groups
- Agricultural groups

For full information on showings of "DEEP WATERS" write the nearest Layne Associate Company

LAYNE ARKANSAS COMPANY
Stuttgart, Arkansas

LAYNE ATLANTIC COMPANY
Norfolk, Virginia

LAYNE CENTRAL COMPANY
Memphis, Tennessee

INTERNATIONAL WATER SUPPLY LTD.
London, Ont., Canada

INTERNATIONAL WATER CORP.
Pittsburgh, Pennsylvania

LAYNE LOUISIANA COMPANY
Lake Charles, Louisiana

LAYNE MINNESOTA COMPANY
Minneapolis, Minnesota

LAYNE NORTHERN COMPANY
Mishawaka, Indiana

LAYNE NORTHWEST COMPANY
Milwaukee, Wisconsin

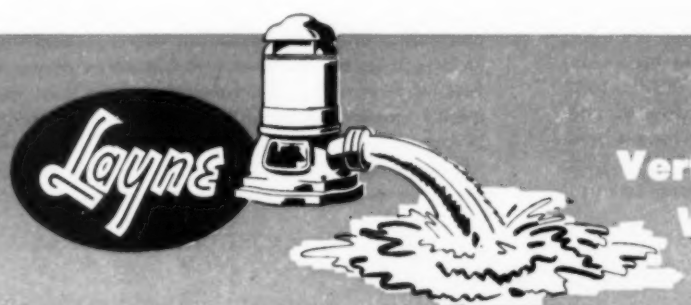
LAYNE NEW YORK COMPANY
New York, New York

LAYNE OHIO COMPANY
Columbus, Ohio

LAYNE PUMPS, INC.
Lubbock, Texas

LAYNE TEXAS COMPANY
Houston, Texas

LAYNE WESTERN COMPANY
Kansas City, Missouri



Water Wells
Vertical Turbine Pumps
Water Treatment

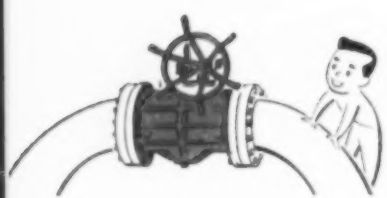
Let's Face the Facts...

DOES VALVE LUBRICATION

Now and then someone revives an old argument—"it costs too much to maintain lubricated valves."

On the surface, that sounds logical. But if that really was a fact, millions of Nordstrom lubricated valves in service today could never have been sold.*

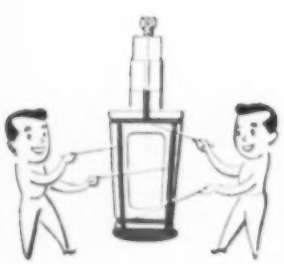
WHAT IS THE ADVANTAGE OF A LUBRICATED VALVE?



The most important function of lubricant in a Nordstrom valve is to give a tighter seal than can be accomplished through any other method yet developed. The thin film of plastic lubricant that is forced around the ports of the plug is a pressure seal in itself.

Of course, the lubricant has other obvious advantages—the same advantages it has in your automobile, or in any other mechanical equipment where metal rubs metal. The lubricant all but eliminates the possibility of galling or seizing, and consequently keeps the valve ready to operate in a hurry. A lubricated Nordstrom valve operates easily even against high line pressures, because the plug turns *within* the line, rather than being forced or wedged *against* it. Since it takes only a quarter turn of the plug to open or close the valve, it operates in seconds instead of minutes.

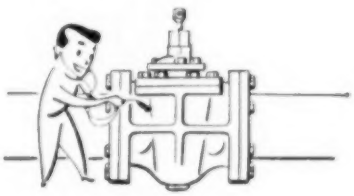
WHAT DOES THE LUBRICANT DO?



In a Nordstrom valve, lubricant is forced through a series of grooves surrounding the plug ports. There it acts as an extra seal against the little leaks that become big problems. It is also forced into a lubricant chamber at the small end of the plug where it serves as a hydraulic jack to keep the plug easy to turn.

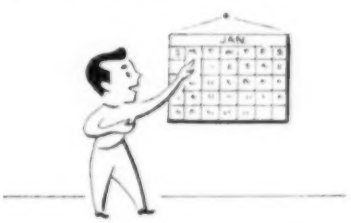
Finally, it *lubricates* . . that is, it prevents grinding wear, fills tiny imperfections that may develop, and it lets the plug slide without grating.

WILL A NORDSTROM VALVE WORK WITHOUT LUBRICANT?



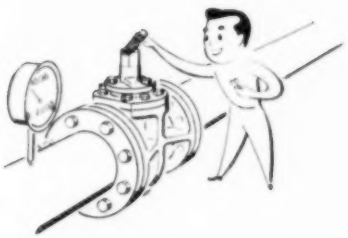
Yes, but then the whole advantage of a lubricated valve is lost. Your car will also operate without lubricant, but with proper lubricant, it is far more efficient, lasts many, many times longer, needs much less maintenance, and is safer. So is a valve. Nordstrom is fundamentally a valve—a plug valve made to exceptional standards of tolerance and quality—but it is the internal Nordstrom lubrication system which raises its performance standards above ordinary valves.

HOW OFTEN SHOULD NORDSTROM VALVES BE LUBRICATED?



Like your car, that depends upon the service—the temperature, process, frequency of operation, etc. It's hard to generalize, but your Nordstrom sales engineer can advise you. Using Rockwell lubricants, made especially for Nordstrom valves, is one way to reduce frequency of lubrication in many cases. Also, Rockwell markets mechanical lubrication equipment to make scheduled lubrication easy. Nordstrom Hypreseal valves are now built with an external fitting so that it is unnecessary to remove any parts from the valve before lubrication.

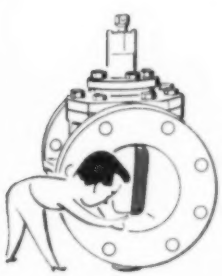
COST MONEY OR SAVE MONEY?



WHAT LUBRICANTS SHOULD BE USED?

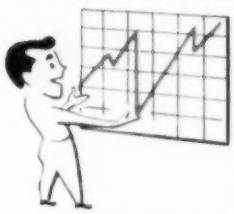
Part of the effect of lubricating your car is lost if you use improper lubricants. That is also true of lubricated valves. Genuine Rockwell lubricants will save you money—they are the result of the longest and most extensive research into valve lubricants by any company. They are the result of years of field experience with nearly every process condition. For many services there are variations of Rockwell lubricants compounded to offset specific line conditions. Also, for many services Rockwell Hypermatic lubricant may be recommended. This lubricant, which is compressible and energizable, regenerates itself in the lubrication system, greatly reducing lubrication frequency. In any case, consult your Nordstrom sales engineer.

HOW LONG WILL PROPERLY LUBRICATED NORDSTROM VALVES LAST?



That's impossible to answer, since many of the first Nordstrom valves put into regular service are still going strong. The service has a lot to do with it, naturally. In gas service, there are many valves with more than 30 years service. In the valve-killing application of drilling rig mudlines, Nordstrom valves have been disassembled for inspection after more than 150,000 feet of hole on many occasions, found to be without wear, and returned for more service—often four times the life of ordinary valves. In a two-year paint plant test, Nordstrom valves were the only ones that did not need to be replaced because of leakage. Nordstrom files are full of such authentic field case histories—ask your Nordstrom sales engineer.

WHAT ABOUT MAINTENANCE COSTS FOR NON-LUBRICATED VALVES?



In any but the most simple services, any kind of valves need *some* maintenance. But in the case of Nordstrom valves, maintenance is generally confined to adding lubricant at intervals. Over a 20-year period, Nordstrom sales of repair parts have been less than half of one per cent of sales. In several plants in which records were kept and where Nordstrom and other valves were used, repair parts for Nordstrom valves ran about one-tenth of other makes.

The analogy to your car carries over here—if you don't lubricate it, you save on lubricant, but pay the far, far higher costs of part replacement. And more particularly, you'll need a new car much more often.

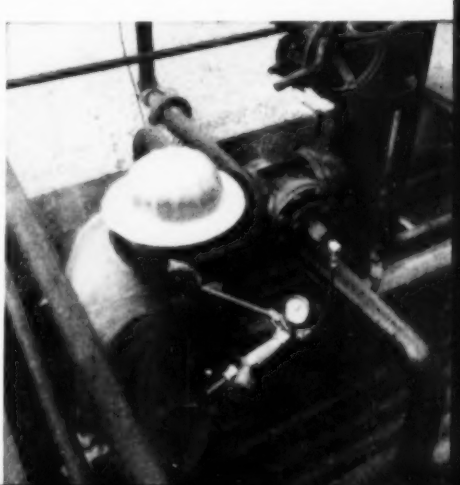
When you consider valve maintenance, be sure to count *all* the costs—not just simple service, but major repairs and complete replacement costs, shutdowns, extra labor to operate, and *all* factors.

If you do, if yours is a typical application, you'll find that year-in and year-out, the most economical valves you can use are Nordstroms.

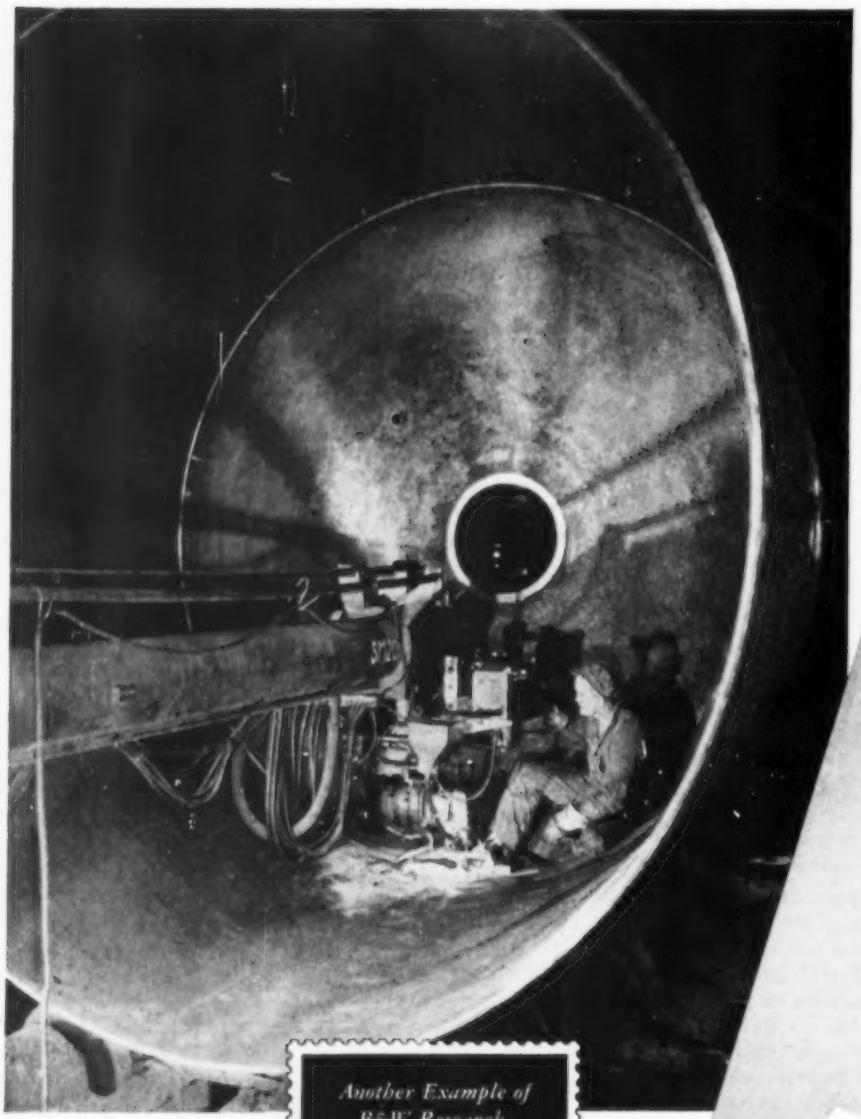
If you'd like to discuss the suitability of Nordstrom valves for any service, let us know. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

ROCKWELL Built
Nordstrom Valves
Lubricant-Sealed for Positive Shut-Off

* Nordstrom invented lubricated valves more than 30 years ago. Since that time, several million have been installed in hundreds of widely varied petroleum, gas, chemical and other process services. With by far the most complete range of sizes and pressures, and many patents on construction details, Nordstrom is the leader in lubricated valves.



this Plus Value in B & W process equipment



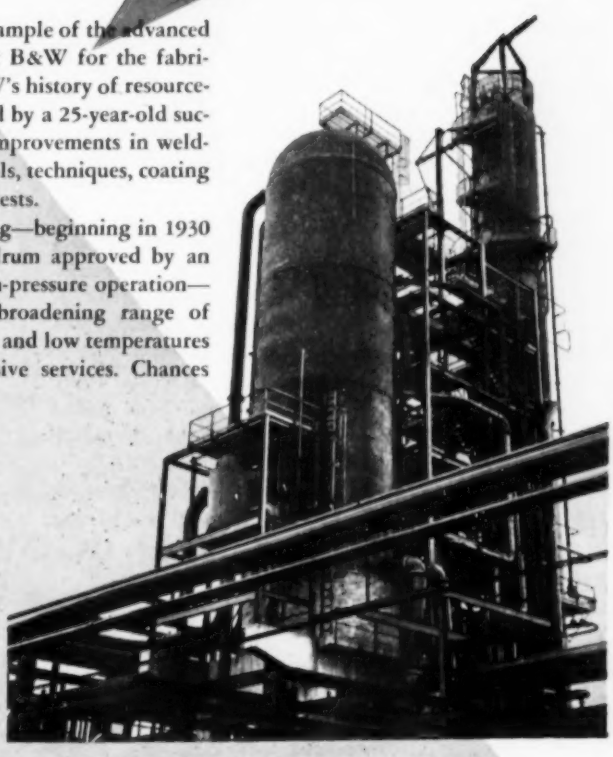
Another Example of B&W Research, Engineering & Facilities

S-4097

PAYS DIVIDENDS HERE

Illustrated at left is a typical example of the advanced welding practices employed at B&W for the fabrication of pressure vessels. B&W's history of resourceful engineering is distinguished by a 25-year-old succession of developments and improvements in welding machines, automatic controls, techniques, coating of electrodes, inspections, and tests.

B&W's leadership in welding—beginning in 1930 with the first welded boiler drum approved by an engineering authority for high-pressure operation—is being applied to an ever-broadening range of quality-welded vessels for high and low temperatures and pressures, and for corrosive services. Chances are B&W has the economical solution to your process equipment problems. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.



BABCOCK & WILCOX

Rigid testing of *Explosion-Proof* CONDULETS* *assures safety and long dependable service*

Probing for maximum exterior operating temperature on a Type EVA Explosion-Proof Lighting Fixture using a multiple point recording potentiometer.

Crouse-Hinds extensive laboratories and modern manufacturing combine to give you top quality

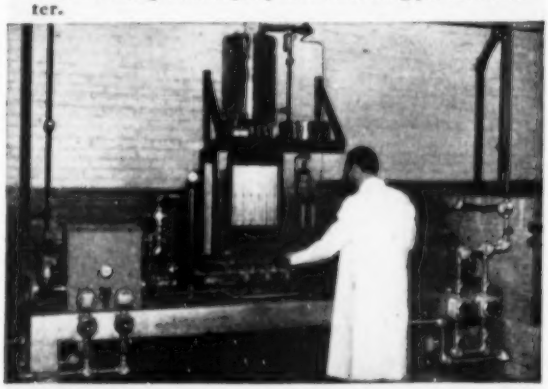
Laboratory testing is one of the key operations in the production of electrical equipment of the highest quality. Crouse-Hinds laboratories are equipped with the latest scientific instruments and staffed with expert technicians.

Products are constantly tested to make sure that they are being made to withstand field conditions. New devices are tested to predetermine their meeting or surpassing the requirements of Underwriters' Laboratories.

The photographs at the right show three of the many testing operations that are done in the Electrical Laboratory. It is equipped with apparatus for making both alternating and direct current tests, heat tests, pressure tests and many others.

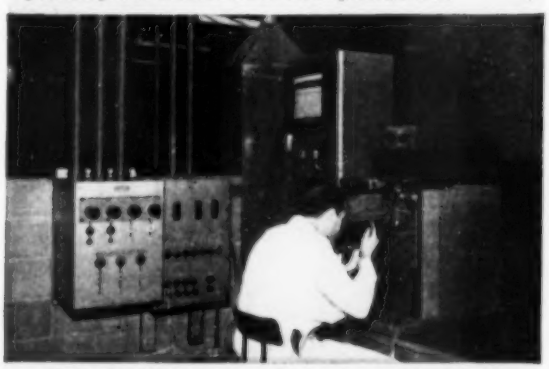
Close cooperation between Crouse-Hinds laboratories and manufacturing departments is one of the reasons why Condulets have been the "Standard of Quality" for nearly fifty years.

Specify CONDULETS on every job. They're made right ... to serve you better ... and last longer.



Adjusting carburetors and flow meters to create a predetermined explosive mixture within an explosion-proof Condulet for an explosion test.

When quality counts
... you can count on Condulets



Photographing the pressure wave in the Oscilloscope to determine the maximum explosion pressure within an explosion-proof Condulet that is behind the concrete wall.

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

OFFICES: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver
Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — New Orleans
New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — St. Paul
Tulsa — Washington. RESIDENT REPRESENTATIVES: Albany — Atlanta — Baltimore — Charlotte
Corpus Christi — Reading, Pa. — Richmond, Va. — Shreveport
Crouse-Hinds Company of Canada Ltd., Toronto, Ont.

CONDULET — First in the field — STANDARD OF QUALITY

*CONDULETS are made only by CROUSE-HINDS

A Nationwide Distribution Through Electrical Distributors

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

Fire Fighters Approaching Blazing Oil Tanker — armed with Rockwood equipment.

Navy uses foam to put out fire

160,000 barrels of high octane gasoline aboard the tanker above were ignited when it collided with another tanker in the Delaware River.

The picture shows a Navy fire-fighting team approaching the blaze from the tug USS Toka. To cool the decks before boarding the tanker, they are using: a 2½" Rockwood In-Line Eductor through which Rockwood FOAM is introduced — a 2½" FFF Rockwood FogFOAM Nozzle with FOAM Shaper for discharging a solid straight FOAM stream — and 2½" and 1½" Rockwood WaterFOG Nozzles through which a straight water stream is being discharged.

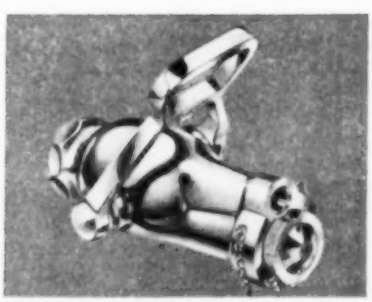
Under the direction of Lt. Comdr. Louis O. Lindeman, the 10-man Navy team boarded the ship, pumped FOAM into tanks below the decks and put out the blaze in 6 hours. *Almost 92% of the gasoline cargo was saved!*

This dramatic example of the effectiveness of Rockwood equipment in action is typical of Rockwood's ability to engineer water to cut fire losses.

ROCKWOOD SPRINKLER COMPANY

ROCKWOOD *Engineers Water . . . to Cut Fire Losses*

Rockwood Type FFF FogFOAM Nozzle with Foam Shaper discharges long, solid FOAM stream. The 2½" size FOAM stream is approximately 60 feet. Discharges 200 g.p.m. @ 100 psi.



Rockwood Type SG-4B WaterFOG Nozzle discharges high velocity WaterFOG, straight water stream or low velocity WaterFOG from extension applicator. For ¾", 1", 1½" and 2½" fire hose lines.

SEND FOR THIS INFORMATIVE BOOKLET

ROCKWOOD SPRINKLER COMPANY
Portable Fire Protection Division
102 Harlow Street
Worcester 5, Mass.

Please send me your illustrated booklet on Rockwood fire-fighting products.

Name .....

Title .....

Company .....

Street .....

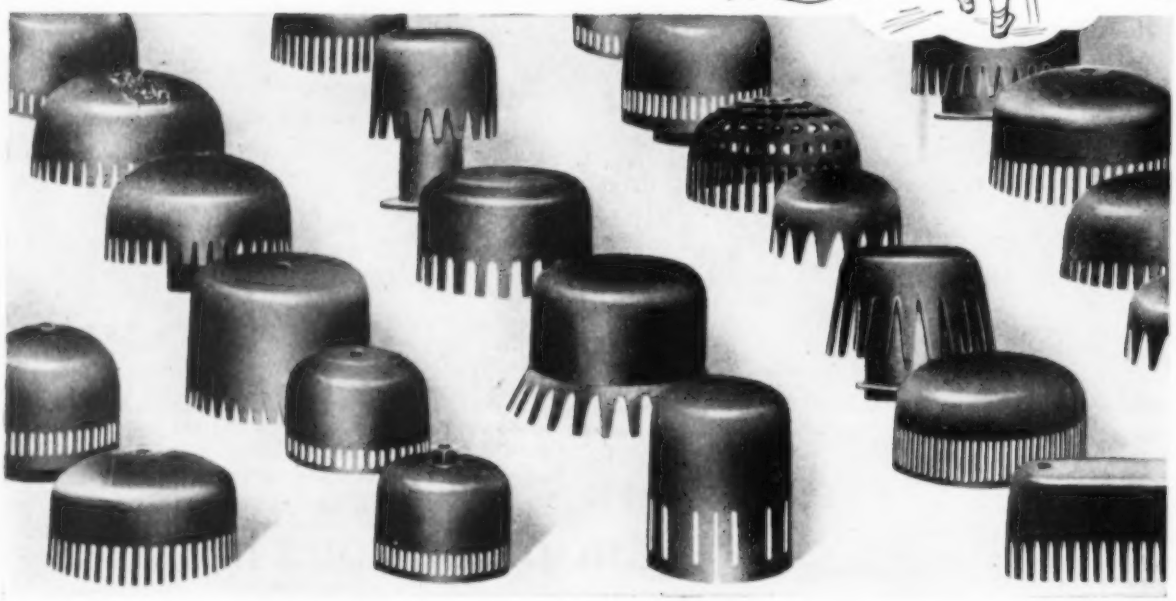
City .....

Zone ..... State .....

You'll Be Days and Dollars Ahead

WITH

PSC BUBBLE CAPS



300 Standard Styles of Caps & Risers *Promptly* Furnished *Without Die Cost*

With dies on hand for 300 styles of bubble caps and risers, The Pressed Steel Co. saves many customers not only the cost of dies but also design and delivery time. Check PSC and you can be days and dollars ahead.

Another advantage PSC customers enjoy: -- we fabricate from the complete list of alloys. Thus we are able to use the one particular alloy which best meets your coking and corrosion conditions.

Special caps to your order. Cap, riser and assembly details can be modified in an unlimited number of ways to suit your needs. Furnished for all methods of tray assembly. Complete engineering details on all 300 styles in Catalog 52.

Send for Process Equip. CATALOG 52

THE PRESSED STEEL COMPANY

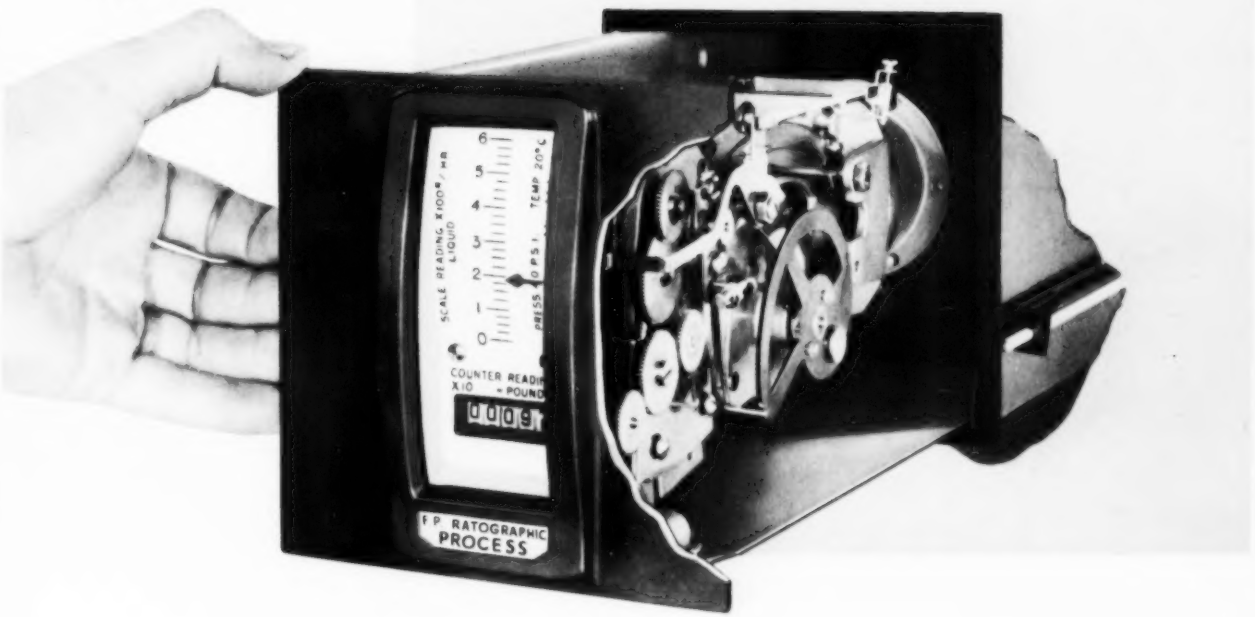
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆

NEW

Ratographic* totalizer



complete with continuous rate indication

- continual integration at rate of 24 times per minute
- dust-proof drive mechanism immersed in oil
- heavy duty 100 rpm — 72 pole synchronous motor
- standard size pneumatic receiver and integrator
- front-of-panel accessibility and removal
- accuracy within 1% of full scale

Here, for the first time, is a *full-size*, rugged totalizer — so designed that it can be used in full size, miniature or graphic panels. A companion to the F & P Ratographic miniature indicator, it is another step in complete process instrumentation developed and perfected by the skilled engineers at Fischer & Porter Company.

The entire unit occupies only six inches square of panel space. In extended position, as shown, instrument continues to function, thus easily enables observation of mechanism. The highly accurate integrating unit gives the equivalent of continuous integration. The many other new features combined in this instrument suggest a careful comparison. Full information on request.

*T. M., F&P Co.

complete process instrumentation

FISCHER & PORTER CO.

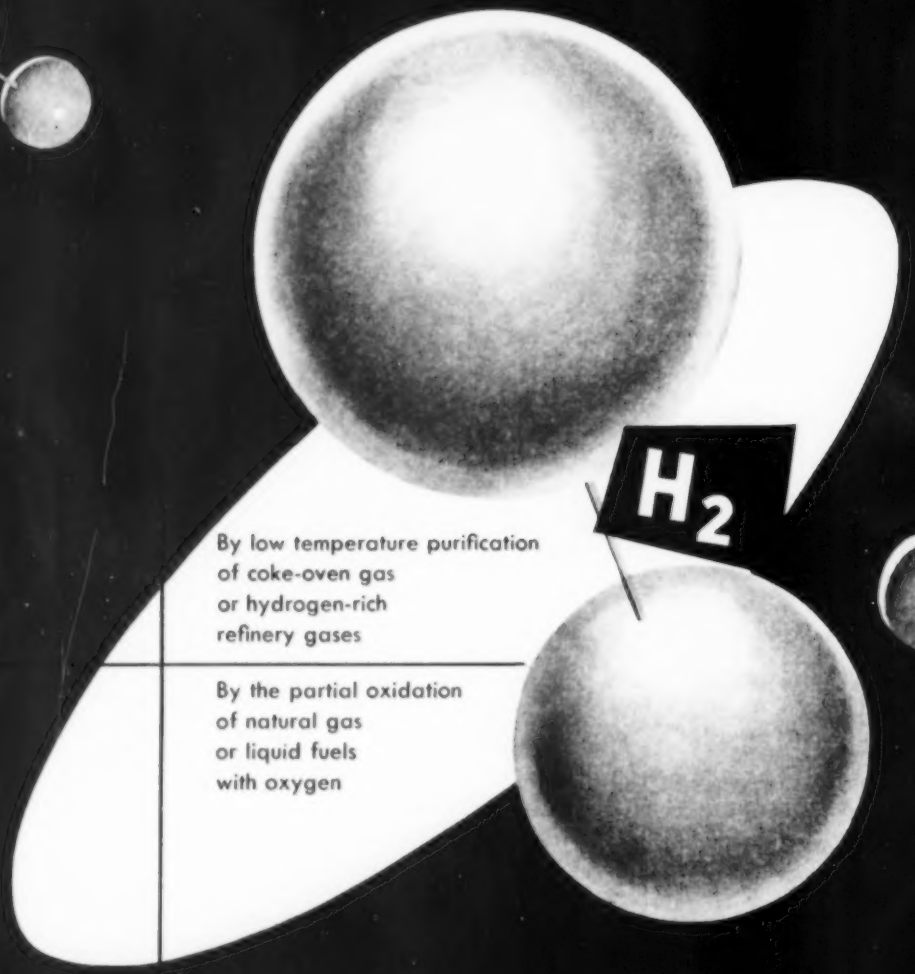
2400 County Line Road, Hatboro, Penna.

2241

Company owned sales and service branches strategically located throughout the world.

hydrocarbon

Low Cost—High Purity HYDROGEN



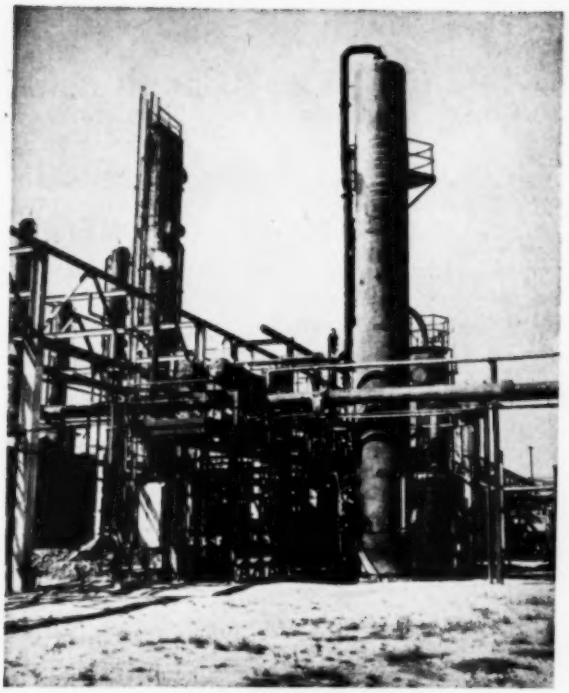
By low temperature purification of coke-oven gas or hydrogen-rich refinery gases

By the partial oxidation of natural gas or liquid fuels with oxygen

HYDROCARBON RESEARCH, INC.
115 Broadway, New York 6, N. Y.
Cable: Hydrocol

HRI
petroleum and chemical processing for profit

TRENTON, NEW JERSEY—Hydrocarbon Research, Inc., Development Laboratory, P. O. Box 1419.
PARIS, FRANCE—Hydrocarbon Engineering, S.a.r.L. 44, Avenue des Champs-Elysées. Cable: Hydrocarbon.
DUESSELDORF, GERMANY—Hydrocarbon Mineraloel, G.m.b.H., 15-17 Fuerstenwall. Cable: Hydromin.
RIO DE JANEIRO, BRAZIL—General Heitor Pedroso, Rua da Quintanda, 20, Sala 801. Cable: Bispetro.
NEW DELHI, INDIA—A. R. Palit & Company, Sujan Singh Park, Post Box 671, Cable: Palitar



The internal parts of the soda regenerator column shown on the right, have been gradually changed to all-Monel construction to withstand the corrosive attack of spent caustic. On the elevated structure to the left of the tall column is a vapor-to-feed exchanger which contains a Monel tube bundle.

How to

Reduce Corrosion

in the

Regeneration of Caustics

Here's one process in which corrosion takes an unnecessarily heavy toll of equipment.

Many refineries, however, are rocking corrosion back on its heels.

They're using Monel for regenerator reboilers and tubes ... for linings and internal parts of regenerator towers ... and for pumps, piping and preheaters handling hot caustic solutions.

The results have been outstanding.

At the Shell Oil Company refinery in Wood River, Illinois, for example, a number of Monel bubble caps in a Monel tray displayed excellent resistance to corrosion during a long experimental service period. At the same time, assemblies of conventional materials were severely corroded.

As a result of the test, the internals of the column have been gradually changed to all-Monel construction, and certain sections of the shell have been Monel-lined.

Then there's the experience of a Texas refinery. Failure of the preheater tubes in their regeneration system occurred with discouraging regularity at 30-day intervals. So they replaced their Schedule 80 pipe with Schedule 40 Monel. And at last report, the thinner-walled Schedule 40 Monel had been on the job *two full years.*

In addition to Monel, there is another Inco Nickel Alloy to keep in mind for evaporator tubes and other parts of regenerator systems. Its name – Inconel. Offering good resistance to caustic alkalis containing hydrogen sulfide and mercaptans, Inconel is particularly useful for service where metal temperatures above 500° F are encountered.

Before you choose metals for use in the regeneration of caustics, make it a point to investigate Monel and Inconel. Your distributor of Inco Nickel Alloys can give you the latest information on their availability. And of course – it's usually a good idea to anticipate your requirements somewhat in advance.

For many of the facts you'll want to know about Monel and Inconel, read *Some Corrosion Problems in Petroleum Refineries.* This valuable report contains detailed information on 15 actual problems submitted to Inco's Corrosion Engineering Service for analysis. A copy is yours on request.

Always yours for the asking, too, is the help of our Corrosion Engineering Service towards solving any specific corrosion problem you may have. THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N. Y.

Inco Nickel Alloys

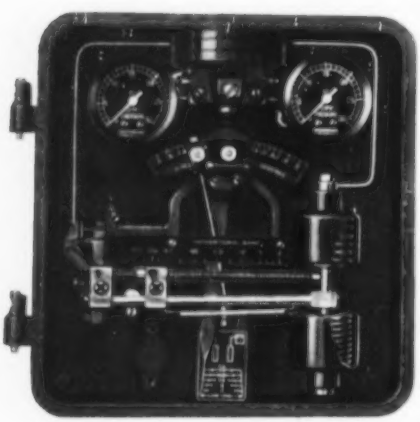
MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL
"S"® MONEL • NICKEL • LOW CARBON NICKEL • DURANICKEL®
INCONEL® • INCONEL "X"® • INCOLOY® • NIMONICS®

6 Reasons

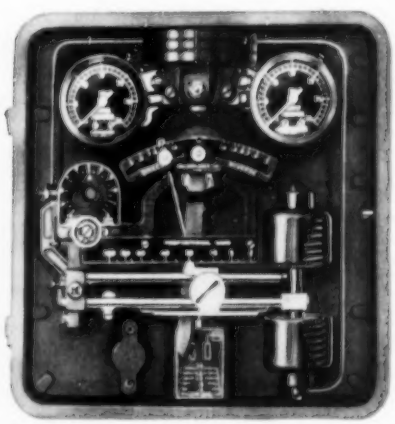
Wide range of selection of the basic controller unit to fit your application is represented by the five single-unit controllers illustrated below . . . five of the many reasons why Masoneilan Liquid Level Controllers offer you more for your money. The sixth is the convenience of grouping any two of these in one case as illustrated in the model to the right. This range of selection enables you to obtain from *one* manufacturer the control equipment for almost any liquid level application.

Model 12800 — The basic proportional controller; may also be used as a transmitter; may be converted in the field to a differential gap controller.

Model 12810 — Adds reset action to the proportional controller. Conversion of Model 12800 may be accomplished in the field if desired.



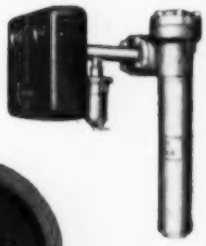
Model 12820 — The pneumatic transmitter provides an output air signal which is proportional to level changes, for indication, recording or control.

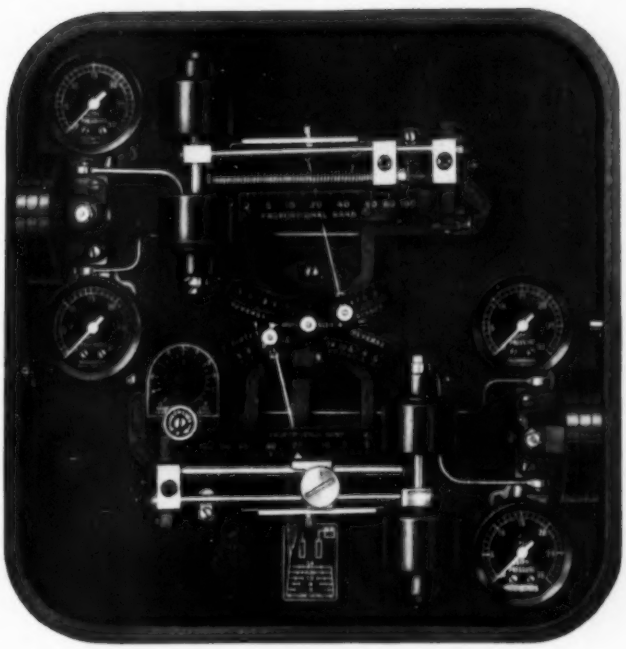


Model 12830 — The differential gap controller. May be converted to a proportional controller in the field if process changes require it.

TWENTY POSSIBLE

Why You Should Select Masoneilan Level Controllers





Model 12800-20 — A duplex model grouping the proportional controller and pneumatic transmitter. Any combination of two identical or dissimilar single units is possible — a total of fifteen combinations.

Model 12840 — The pneumatic set controller provides for remote adjustment of set point. Available with either proportional or proportional-reset action.

Simplicity of design; sensitive accuracy of control; wide choice of materials; ease of maintenance; convenience of installation; and sturdy, long lasting construction are six *other* reasons why you should select Masoneilan 12000 Series Liquid Level Controllers.

ALL HIGH Quality Coefficient PRODUCTS

MASON-NEILAN

REGULATOR CO.

1182 ADAMS STREET, BOSTON 24, MASS.

Sales Offices or Distributors in the Following Cities: New York • Syracuse • Chicago St. Louis • Tulsa • Philadelphia • Houston • Pittsburgh • Atlanta • Cleveland • Cincinnati Detroit • San Francisco • Boise • Louisville • Salt Lake City • El Paso • Albuquerque Charlotte • Los Angeles • Corpus Christi • Denver • Appleton • Birmingham • New Orleans Dallas • Seattle • Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

INSTRUMENT COMBINATIONS

Graphic control... *for leading industries*

The well-established trend to centralized graphic instrumentation has brought with it many specific advantages to the operation of complex, modern processing units. And to realize most fully the potential advantages of improved efficiency, simpler supervision and better coordination, many leading companies have turned to Honeywell graphic control.

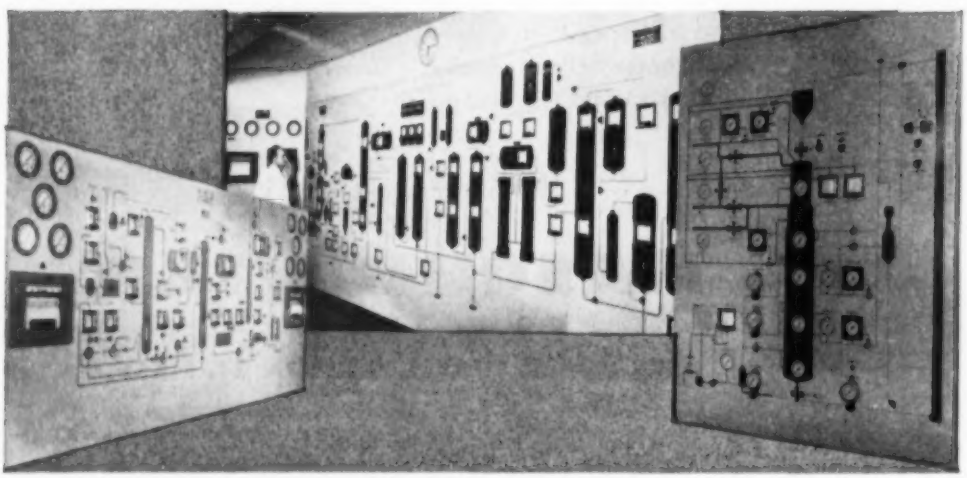
Among the engineering, construction and producing organizations which use Honeywell panels are some of the best-known names in their fields. The ever growing list includes:

C. F. Braun
Catalytic Construction Co.
The Fluor Corporation Ltd.
Foster Wheeler Corp.
Gulf Oil Corporation
Imperial Oil of Canada
M. W. Kellogg
The Lummus Co.
Pan-Am, Southern
Phillips Petroleum Co.
The Refinery Engineering Co.
Shell Oil Co.
Sinclair Refining Co.
Socony-Vacuum Oil Co.
Standard Oil Co. of California
Standard Oil Co. of Indiana
Standard Oil Co. of New Jersey
The Texas Company
Tide Water Associated Oil Company
Union Oil Co. of California

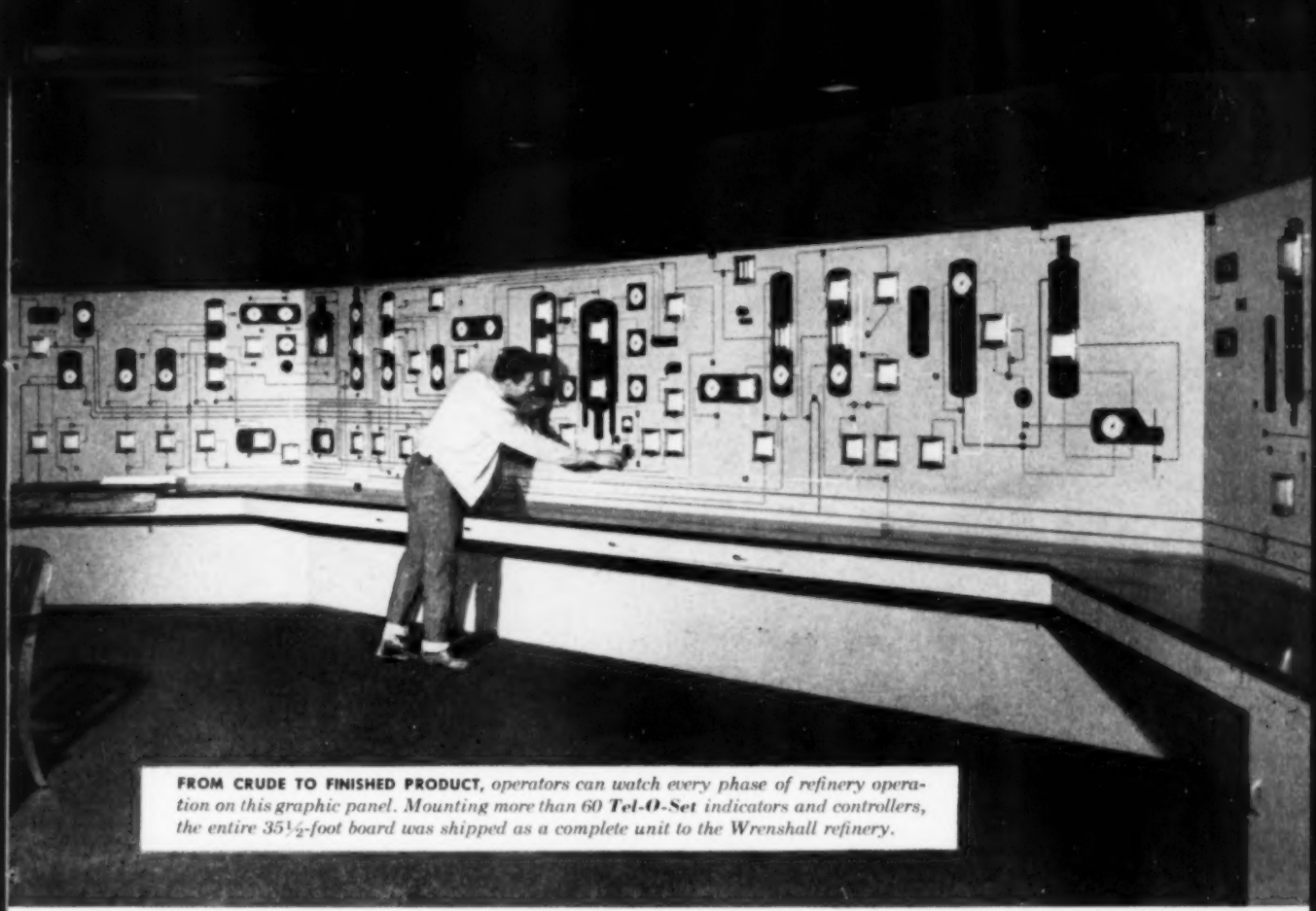
Reasons for acceptance

Behind this industry-wide acceptance stand several definite reasons. First is system engineering . . . by graphic panel specialists who translate process requirements into an integrated, harmonious design. Second is instrumentation . . . including a full line of *Tel-O-Set* miniature indicators, recorders and controllers, and *ElectroniK* instruments for supplementary recording, which enable Honeywell to satisfy the requirements of every phase of process control. And third is workmanship . . . skilled assembly either in a manufacturing department devoted exclusively to this work, or, if desired, at the job site by our own experienced branch installation crews—an organization built up over 15 years for the installation of industrial and commercial control systems.

Graphic control *centralized*



FUNCTIONAL DESIGN *for maximum efficiency is the keynote of Honeywell graphic instrumentation. These typical panels show a few of the varied types which have been built for varied process applications.*



FROM CRUDE TO FINISHED PRODUCT, *operators can watch every phase of refinery operation on this graphic panel. Mounting more than 60* ***Tel-O-Set*** *indicators and controllers, the entire 35½-foot board was shipped as a complete unit to the Wrenshall refinery.*

for complete refinery *on a single Honeywell panel*

THE MOST up-to-date concepts of petroleum processing were embodied in International Refineries' new plant at Wrenshall, Minnesota. Designed and built by the Lummus Company, this refinery produces straight run, cracked and polymer gasolines, diesel and other fuel oils, all of which are distributed by Western Oil & Fuel Co.

An outstanding feature of this new refinery is its continuous flow operation . . . no intermediate storage tanks are needed between processing stages. This "straight through" design naturally calls for precise, closely integrated control of related processes. To meet these exacting control requirements, refinery and design officials selected Honeywell graphic control.

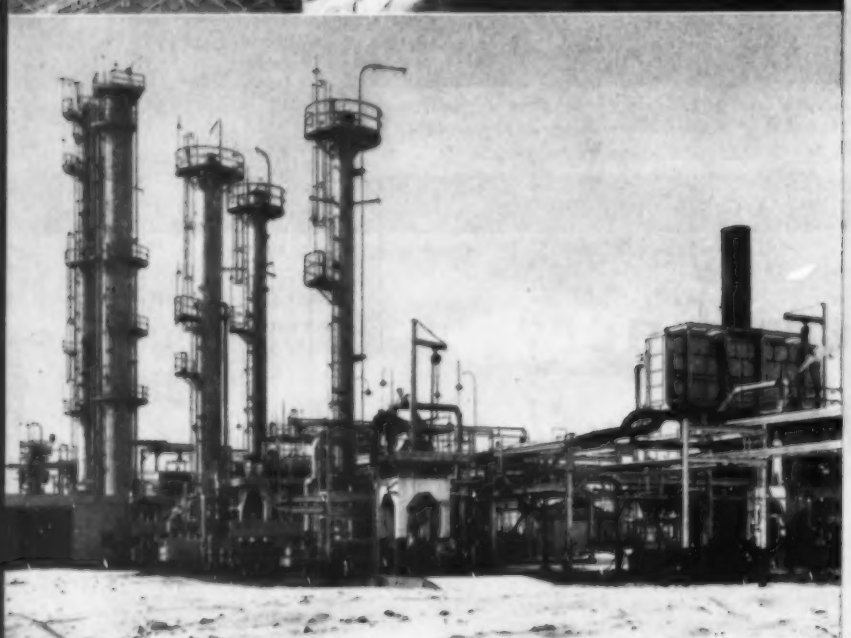
The big graphic panel shown above combines all the instrumentation for eight different refining processes. Operators can follow the entire functioning of the plant from crude to finished products, from this single control center. Worked out in detail by Honeywell design specialists, this panel does the job that would ordinarily require four or more separate panels. Not only were substantial savings effected in space, but the panel affords complete centralization of plant control . . . flexibility to meet seasonal variations in product demand . . . and maximum efficiency of process supervision, both for operators and for management personnel.

Your nearby Honeywell sales engineer will welcome the opportunity to discuss your graphic control requirements. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division,* 4498 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA:** Write for Bulletin 85-20, "Centralized Instrumentation . . . unlimited."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls



PROCON

can build . . .
has built . . .
is building . . .

Auxiliary refinery facilities

Buildings — office, plant

Crude units

Electrical installations

Feed preparation units; Fractionators; Fluid Catalytic Crackers

Gas recovery systems

Laboratories

Major refinery units

Polymerization plants; Platforming units

Roadways; Repairs; Replacements

Sewers

Turnarounds on refinery processing units

Udex aromatic extraction units; Utilities

Vacuum distillation equipment; Vis-breakers

ALL TYPES OF REFINERY PROCESSING EQUIPMENT

The scope of Procon service covers the construction alphabet, including everything from major refinery units to minor auxiliary facilities. Most convincing proof of flexibility is the impressive list of jobs completed or under construction — all types of petroleum processing plants, ranging in size from 500 to 16,000 barrels per day design capacity. Readily adaptable to *any* job, Procon has all the requisites for successful handling of process construction projects *anywhere* in the world.

PROCON *Incorporated*

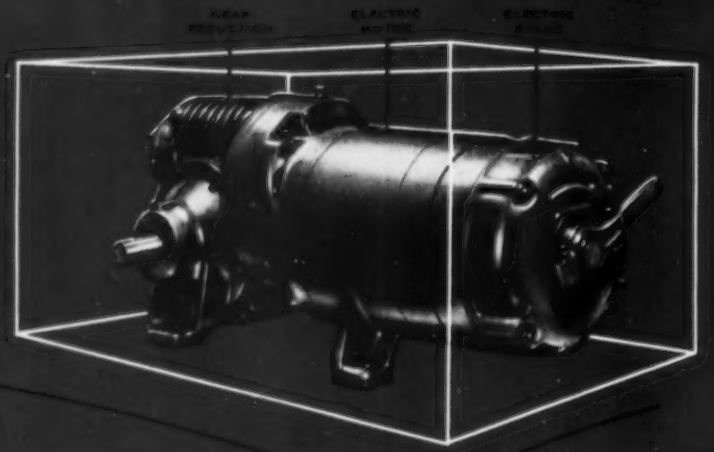
PROCESS CONSTRUCTION

1111 MT. PROSPECT ROAD, DES PLAINES, ILL., U. S. A.

IN ENGLAND

PROCON (*Great Britain*) LIMITED

112 STRAND, LONDON, W. C. 2



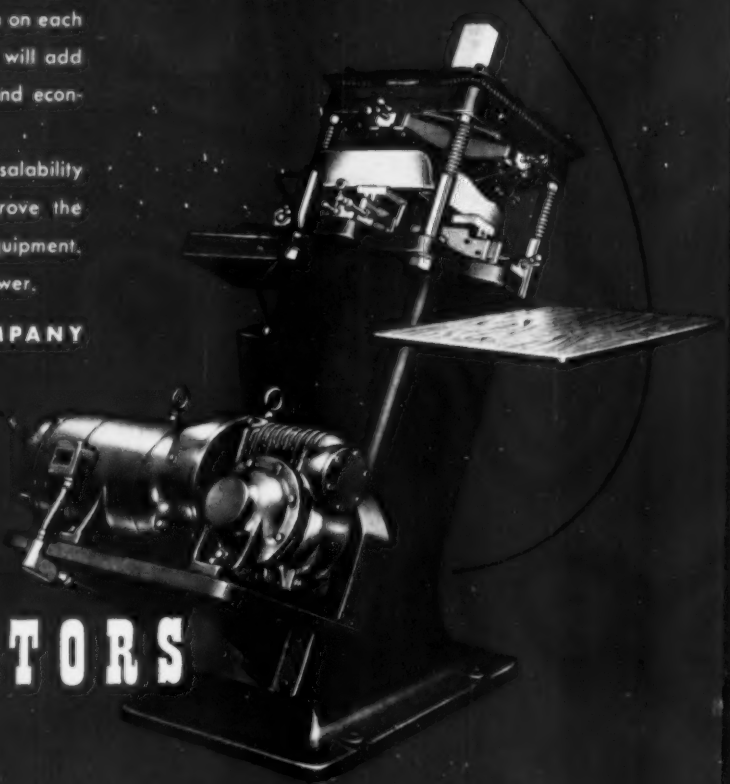
Don't put up with make-shift assemblies when it is so easy to get the RIGHT horsepower, the RIGHT shaft speed, the RIGHT construction features, the RIGHT mounting . . . all combined into one compact, easy to use power package.

All in one package

Master Gearmotors, available in thousands and thousands of combinations of types and ratings, permit you to use a power drive on each job that's just right . . . a power drive that will add greatly to the compactness, appearance, and economy of each of your applications.

Use Master Gearmotors to increase the salability of your motor-driven products . . . improve the economy and productivity of your plant equipment. They're the horsesense way to use horsepower.

THE MASTER ELECTRIC COMPANY
DAYTON 1, OHIO



MASTER GEARMOTORS

TRADE PAPER EDITION
Published by
SCHUTTE and KOERTING
Company

ENGINEERING *News*

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS • FLOW INDICATORS • RADIAFIN TUBES • VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS • DESUPERHEATERS

Why Should You Come To SK For Standard Or Special Heat Transfer Equipment?

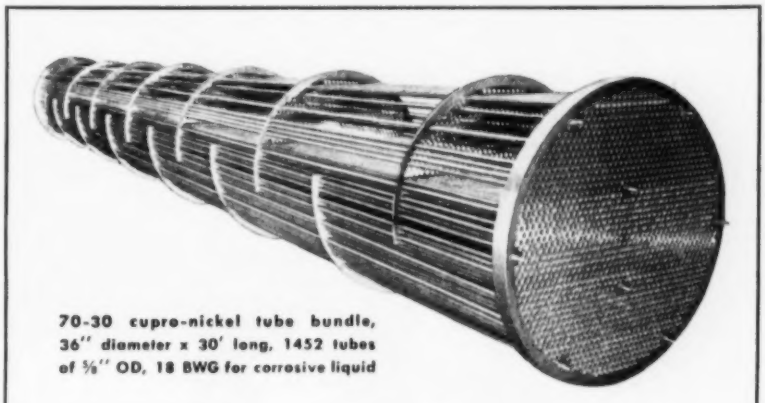
Have you, or are you likely to have, a problem in Heat Transfer involving *special* heavy duty equipment? Does your problem involve out-of-the-ordinary materials, highest precision and uniformity requirements, better than ordinary test and quality control facilities? Would you like to have technical assistance from HT specialists with wide experience?

Or do you just need a well designed, carefully built standard Heat Transfer Unit?

SK manufactures standard equipment, designs and builds special equipment for heat transfer service for pressures up to 5000 psi, temperatures to 1100° F.

And, *here's why* you should come to SK for such equipment—

All SK Heat Transfer Units feature: (1) close tolerances between tube OD and tube sheet hole ID; (2) polished tube ends to insure best metal to metal joint between tube OD and tube hole; (3) shell bores to exact tolerances to insure close fitting baffles for top efficiency; (4) rigid inspection of materials, methods, final assembly; (5) A.S.M.E. Code qualifications; and (6) electronically controlled tube expansion*. SK is particularly well equipped to solve unusual HT requirements, because . . .



70-30 cupro-nickel tube bundle, 36" diameter x 30' long, 1452 tubes of ⅝" OD, 18 BWG for corrosive liquid

SK has specialized in HT problem solving for a great many years—is set-up operationally for this.

The engineering staff is experienced—includes Chemical, Industrial, and Mechanical Engineers who *understand* chemical, power, processing, marine requirements, who *think* on the level you will require, who *talk* your language.

SK research facilities are set up to *anticipate* future requirements.

Production facilities are such that the company has been able to provide radiafin air coolers rated at 7500 hp weighing 47,000 lbs. . . . heat exchangers with special Everdur tube bundles, shells and head lining . . . 36" diameter, 30' long cupro-nickel units for cooling sodium carbonate solution for liquid rheostats . . . special units for handling hydrocarbon gases and synthetic rubber.

Quality Control and test facilities include equipment for hydrostatic, magnaflux, pneumatic, temperature shock, polariscope testing and radiographic inspection (250,000 Volt X-ray machine; Cobalt 60).

Space will not permit many other details worth noting but, if you want more information, do this: (1) write for Bulletin HT-1 which describes the type equipment we make, or (2) request a copy of Vol. 5 No. 3 Engineering News which contains an article on our problem-solving facilities.

***Tubes being expanded using electronically controlled tube rolling machine. This method provides advantages as follows: (1) every tube is expanded uniformly with no over or under expansion, (2) there is no enlargement of tube holes, (3) ligament fracture is prevented, (4) there is minimum tube elongation and tube sheet warpage is reduced, (5) tube wall stresses are reduced, (6) guess work is eliminated, ideal standards for tube joints apply.**

SCHUTTE and KOERTING Company

38 STATE ROAD
CORNWELLS HEIGHTS
BUCKS COUNTY, PA.
Representatives in Principal Cities

HOW TO SQUEEZE PROFITS FROM YOUR HEAVY RESIDUAL OILS...

During the past few years it has been increasingly difficult for many oil refiners to dispose of their heavy residual fuel oils, due to the increasing use of diesel engines by the railroads.

The solution to this problem is the installation of a "Continuous Fluid Coking" unit, engineered and constructed by TRECO. This helps conserve national petroleum resources by making more gasoline and home heating oil from the same amount of crude, with greater profits to the refiner. The process will also aid in the exploitation of reserves of very low grade crude oils which until now could not be economically refined, and offers a greatly improved process.

The coke produced from "Continuous Fluid Coking" is suitable for refinery fuel, burning in power plant boilers or for other industrial applications. With some feed stocks the coke will likely be of greater value, for example, in the production of carbon electrodes for aluminum manufacturers.

TRECO is approved by Standard Oil Development Company to engineer and construct "Continuous Fluid Coking" units. Telephone, wire or write for information as to the possibilities of adapting this valuable new process to your operations.

TRECO

REFINERY ENGINEERING *Company*

HOUSTON ● TULSA ● TORONTO

Approximately sixteen thousand workers in America are killed and two million injured annually in on-the-job accidents. Why this terrible toll of life and limbs? Safety engineers affirm . . . and many safety-minded business and industrial firms prove constantly that the majority of on-the-job . . .

ACCIDENTS CAN BE PREVENTED

. . . through properly-planned and properly-directed Safety Programs. Do YOU have a Safety Program? If you do, it's your responsibility . . . and to your advantage, to give it your whole-hearted backing.

If you do not have a Safety Program, it is vitally important, both for your interests and the interests of your employees to get one started as quickly as possible. Our Safety Engineers can help you set up such a Program.

Accident PREVENTION *Pays*

Largest Writer of WORKMEN'S COMPENSATION INSURANCE *in Texas*

HOMER R. MITCHELL, *Chairman of the Board* A. F. ALLEN, *President*

Service Offices: ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI • DALLAS • EL PASO FORT WORTH • FREEPORT • GALVESTON • HARLINGEN • HOUSTON • LUBBOCK • MIDLAND ODESSA • PORT ARTHUR • SAN ANGELO • SAN ANTONIO • SHERMAN • TYLER • WACO • WICHITA FALLS

TEXAS EMPLOYERS INSURANCE ASSOCIATION

HOME OFFICE • DALLAS, TEXAS

All SHELL AND TUBE ...HEAT EXCHANGERS by Vogt

ABOVE: View of new construction at Louisville Refining Company.

BELOW: Some of the many Shell and Tube Exchangers.

Engineered and Licensed by UNIVERSAL OIL PRODUCTS CO.

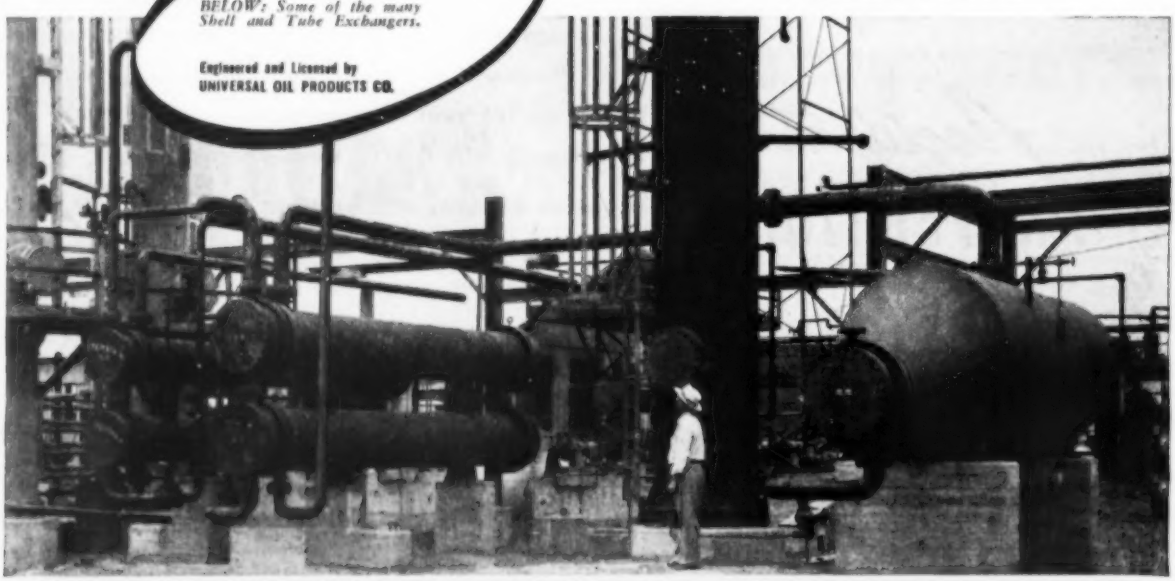
At LOUISVILLE REFINING CO.'S New CATALYTIC CRACKING PLANT

Premium gasoline production has been boosted 20% from the same amount of oil charged since the Louisville Refining Company's new Catalytic Cracking Plant went on stream.

The new plant uses Vogt Shell and Tube Heat Exchangers exclusively and they make a significant contribution to the efficient and economic operations of this progressively modern refinery.

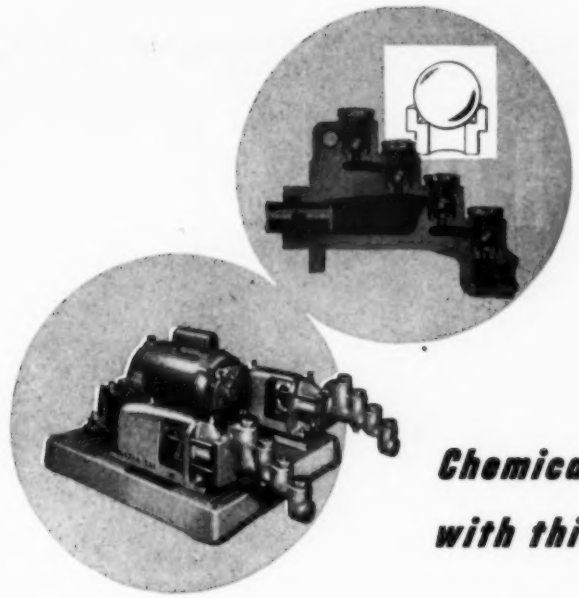
Vogt Shell and Tube Heat Exchangers are available in many different types, with fixed or removable tube bundles, to meet the special problem and specific operating conditions of each installation. They are constructed from carbon and special steels to meet every temperature, pressure, or vacuum service requirement.

WRITE FOR BULLETIN HE-6



HENRY VOGT MACHINE CO. Louisville 10, Ky. •

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, CLEVELAND, ST. LOUIS, DALLAS, CHARLESTON, W. VA.



Basic design simplicity of the *exclusive* Milton Roy liquid end step-valve assures high and reproducible volumetric efficiency. The self-cleaning *double* ball-checks seat positively, dislodge any trapped particles by spinning action, are snap-acting.

Chemical Treatment Costs Drop with this Milton Roy Pump

CONTROLLED VOLUME PUMPING

INSTRUMENTATION

PROCESS CONTROL SYSTEMS

BLENDING AND FORMULATING

ON THE JOB in a well-known chemical processing plant, this Milton Roy Motor-Driven Controlled Volume Pump meters the flow of concentrated sulphuric acid to the deoiling step in an ore flotation process. The accurate control of acid addition results in minimum usage of concentrated sulphuric acid and subsequent caustic, thereby lowering treatment costs.

This is a typical example of how Milton Roy Pumps effect dollar savings in hundreds of applications throughout industry. As motor-driven or air-powered units, or as components of automatic systems, their accuracy and long service life bring measurable returns to users. In *boiler feed water treatment*, for example, they are used in all forms of handling internal or external treating chemicals; in *petroleum processing*, for crude desalting and gasoline treating; in *textile manufacturing*, for acid, alkali or bleach baths; in *instrumentation*, to satisfy control requirements.

These are rugged, dependable pumps. They meter practically any liquid—abrasive slurries, solids in suspension, solvents—in capacities from 3 milliliters per *hour* to 45 gallons per *minute*, against pressures up to 25,000 pounds per square inch with instrument accuracy. We invite your inquiries.

Bulletin No. 553 tells you *how you can profitably use Milton Roy Motor-Driven Controlled Volume Pumps in* ***your*** *business. Write for your* ***free*** *copy.*

MILTON Roy COMPANY

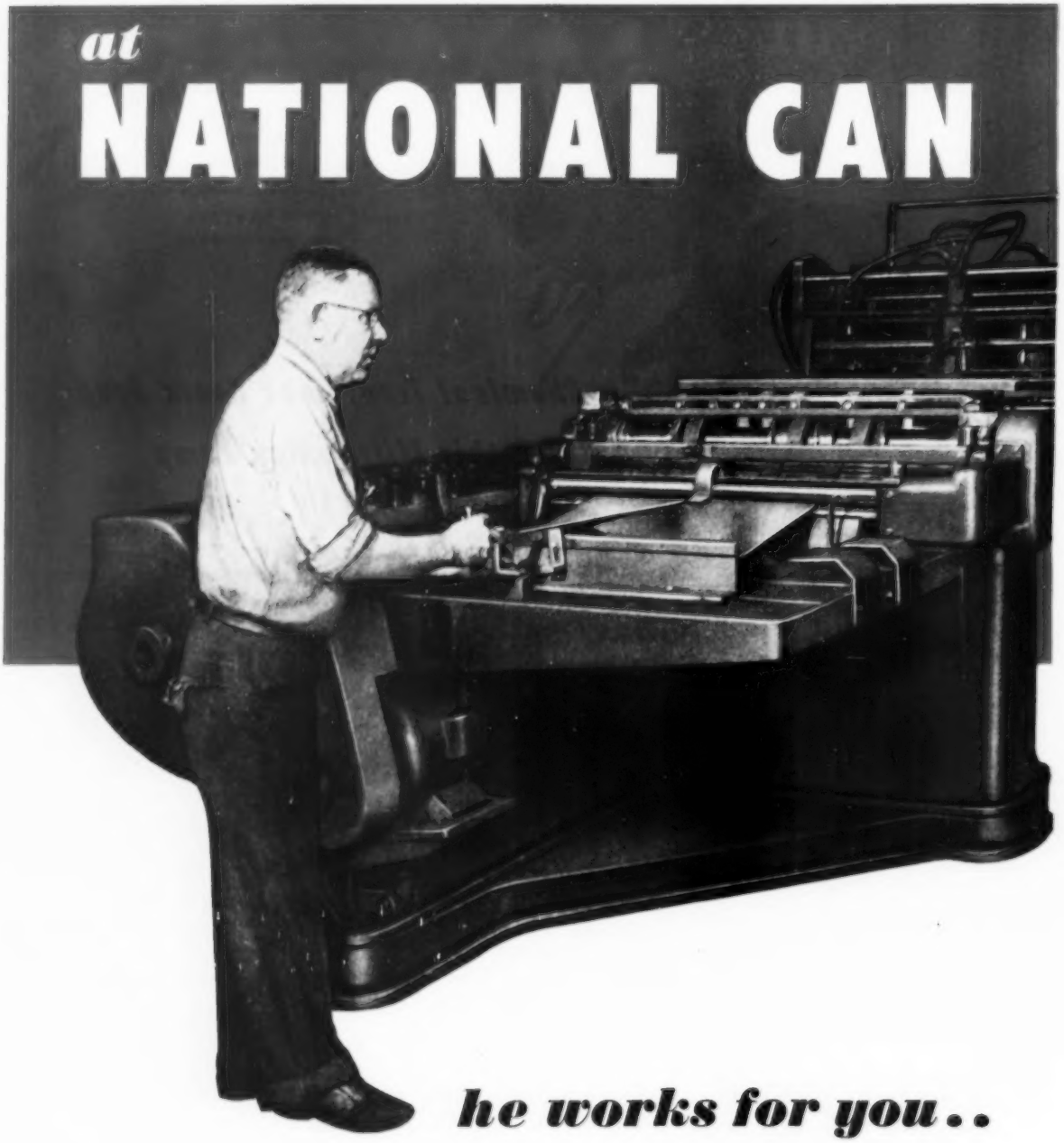
Manufacturing Engineers • 1315 E. MERMAID LANE • PHILA. 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

Engineering Representatives in the United States, Canada, Mexico, Europe, Asia, South America and Africa.

at

NATIONAL CAN

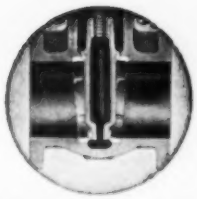


he works for you . .

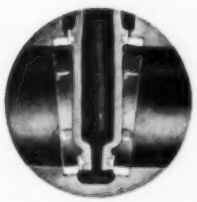
NC

NATIONAL CAN
CORPORATION
Executive Offices
3217 WEST 47th PLACE, CHICAGO 32, ILLINOIS
Plants At: CHICAGO, ILL. • MASPETH, N. Y.
BALTIMORE, MD. • HAMILTON, OHIO

Leonard Krysiak, who has been "setting up" machines at National Can for more than 24 years, is an important part of our "Quality Control". The quality of YOUR can depends in ever so many ways on the attention to detailed specifications and the adherence to close tolerances that are second nature to "old timers" like Leonard. Typical National Can service...where it counts!



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

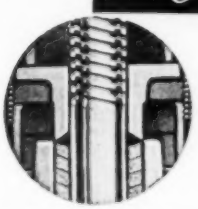
WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.



Brass Liner on Glands assures greater resistance to corrosion and scoring.

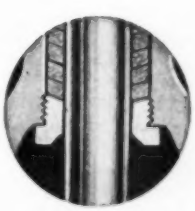
WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

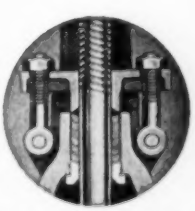
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



Bronze Back-Seat Bushings in bonnets of OS&Y valves.

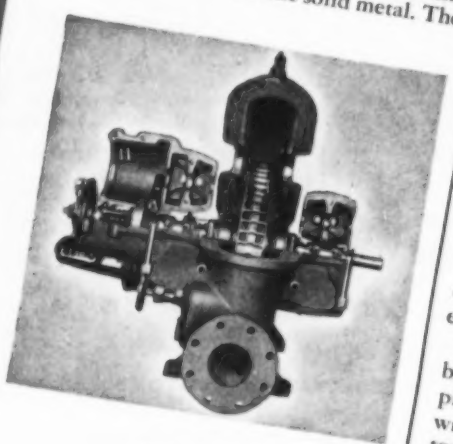
Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

TERRY

The rotor of a Terry Solid-wheel Turbine is a single forging of special composition steel. It is first rough turned in two operations, as illustrated, and then two cuts are taken to mill the semi-circular buckets from the solid metal. The wheel at the top has been finished, ready for mounting on the shaft. *The result is a single-piece wheel with no parts to loosen or work out.*



As the only function of the blades is to form a series of pockets, wear of the blades is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

It is impossible for the blades to foul. They have large clearances, and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

The Terry Solid-wheel Turbine is an extremely reliable piece of equipment. Why not write for complete details today?

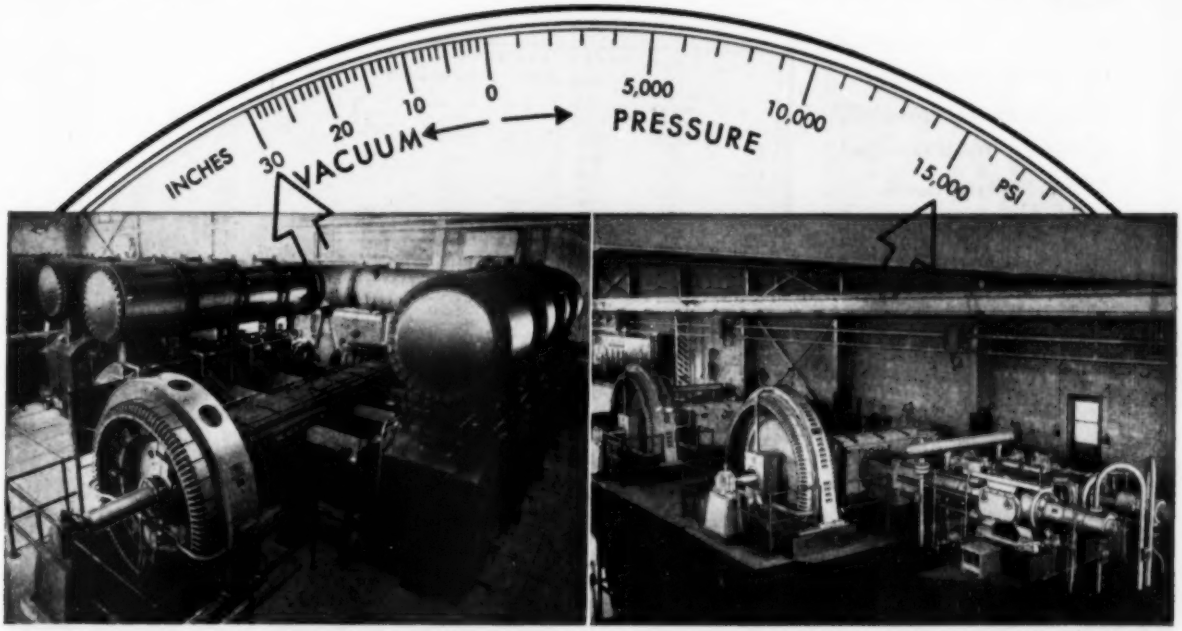
THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1188

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

any pressure or vacuum you want–



Three 2000-hp Ingersoll-Rand HHE Vacuum Pumps for exhausting testing chambers to simulate high altitude flying conditions. Piston displacement of 51,508 cfm is believed largest built to date in reciprocating equipment.

Two 900-hp Ingersoll-Rand 2-stage HHE Compressors boosting a mixture of hydrogen and nitrogen from 3500 to 15,000-psi pressure in the manufacture of synthetic ammonia. Two 2250-hp 4-stage units handle the primary compression to 3500 psi.

from high vacuums to 15,000 psi pressure

Ingersoll-Rand Compressors meet industry's exacting needs with traditional I-R economy, dependability and low maintenance.

When a southern chemical corporation wanted to compress nitrogen and hydrogen to 15,000 psi in the production of synthetic ammonia, Ingersoll-Rand compressors were chosen for the job. When the aircraft industry needed big vacuum pumps to exhaust testing chambers in order to simulate high altitude flying conditions, again Ingersoll-Rand equipment was selected.

The installations pictured here are typical of the wide range of specialized services that I-R compressors are performing.

If you have a problem involving the compression or evacuation of air or gases, remember that for scores of years Ingersoll-Rand has been designing and building reciprocating, centrifugal, and steam-jet equipment—and combinations of these—to meet the most exacting requirements in all kinds of industries. Your I-R representative is well qualified to give you expert assistance, no matter what the gas, pressure, or process.

Ingersoll-Rand

833-1 11 BROADWAY, NEW YORK 4, N. Y.

MEMO

OFFICE OF THE PRESIDENT

Scott—
Did you know Metal Goods Corporation has such a complete stock of mechanical steel tubing and cold finished bars?

J. L.

STOCK LIST

COLD DRAWN SEAMLESS MECHANICAL TUBING
COLD FINISHED STEEL BARS • STEEL TUBING

METAL GOODS CORPORATION — MGC — SAINT LOUIS, MISSOURI

COLD DRAWN SEAMLESS MECHANICAL TUBING

GRADE MT-1015 RANDOM LENGTHS, 17-24 FEET

O. D.	Decimal Wall Gauge	Quantity in Feet
1/4"	.028	1,395
1/8"	.065	5,203
5/16"	.035	226
	.049	54
	.065	1,114
	.083	784
5/8"	.065	19,640
3/4"	.083	240
	.120	495
	.156	*
	.188	50
7/8"	.083	1,248
	.109	1,667
	.120	1,904
	.156	2,198
	.188	1,582
1"	.120	1,465
	.156	1,969
	.188	103
	.250	886
1-1/8"	.120	1,754
	.188	305
	.250	962
1-1/16"	.188	1,528
1-1/4"	.120	1,701
	.156	3,842
	.188	2,309
1-5/16"	.120	868
	.156	1,178
	.188	1,124
	.218	987
1-3/8"	.065	56
	.120	1,865
	.188	*
	.218	*
	.250	509
1-7/16"	.156	1,213
	.188	62
	.250	987
1-1/2"	.035	111
	.120	1,761
	.156	2,868
	.188	260
	.218	*
	.250	22
	.313	643
	.375	*
1-9/16"	.250	*
1-5/8"	.095	475
	.120	*
	.188	750

O. D.	Decimal Wall Gauge	Quantity in Feet
1-5/8"	.218	*
	.250	812
	.375	*
	.438	*
1-3/4"	.120	*
	.188	832
	.218	691
	.250	*
	.313	*
	.375	84
	.500	*
1-13/16"	.188	91
	.313	138
1-7/8"	.120	1,181
	.156	371
	.218	675
	.375	414
2"	.065	1,023
	.095	*
	.120	1,600
	.156	774
	.188	707
	.218	*
	.250	553
	.281	*
	.313	509
	.375	411
	.438	64
	.500	*
2-1/8"	.125	*
	.188	643
	.218	*
	.250	504
2-1/4"	.065	446
	.120	1,647
	.188	1,204
	.218	626
	.250	203
	.375	*
	.625	*
2-3/8"	.156	1,221
	.188	25
	.220	*
	.281	*
	.313	*
	.500	*
2-1/2"	.095	410
	.120	896
	.219	512
	.250	1,084
	.313	*
	.375	358

O. D.	Decimal Wall Gauge	Quantity in Feet
2-1/2"	.438	147
	.500	*
	.750	*
2-1/4"	.120	529
	.188	454
	.250	29
	.375	*
	.500	377
2-7/8"	.188	*
	.218	903
	.250	*
	.438	*
3"	.120	2471
	.156	491
	.188	869
	.218	408
	.250	294
	.375	18
	.500	*
	.562	*
3-1/8"	.188	*
3-1/4"	.120	501
	.188	*
	.250	5
	.375	*
	.500	98
3-1/8"	.188	1,091
	.375	*
3-1/2"	.120	100
	.188	*
	.218	7
	.250	592
	.313	338
	.375	*
	.500	*
	.625	*
3-5/8"	.188	118
	.313	102
	.375	*
	.500	*
3-3/4"	.120	*
	.188	113
	.250	*
	.500	*
4"	.120	*
	.188	267
	.250	197
	.313	*
	.375	*
	.500	*
4-1/2"	.250	207
5"	.250	*

* These items are on order. Delivery expected early third quarter. Consult us for sizes not shown.

COLD FINISHED STEEL BARS

QUANTITY IN POUNDS

ROUNDS

B-33		C-1018-20	
15/64"	153	1/4"	197
11/16"	11,020	5/16"	4,060
1"	9,299	3/8"	4,968
1-1/16"	7,406	9/16"	4,473
1-3/8"	8,257	5/8"	10,000
1-7/16"	32	11/16"	6,046
1-1/2"	6,501	3/4"	5,560
1-9/16"	2,416	13/16"	11,435
1-5/8"	1,981	7/8"	10,800
2"	8,441	1"	12,355
2-3/4"	9,491	1-1/8"	12,350
		1-3/16"	13,839
C-1213		1-1/4"	15,822
5/16"	1,780	1-5/16"	6,152
3/8"	7,300	1-3/8"	10,200
7/16"	8,603	1-7/16"	8,331
1/2"	5,761	1-5/8"	16,059
9/16"	251	1-11/16"	5,560
5/8"	5,714	1-15/16"	3,278
11/16"	6,112	2"	11,939
13/16"	3,506	2-1/16"	2,685
15/16"	6,140	2-1/4"	1,200
1"	523	2-5/16"	1,798
1-1/8"	5,780	2-1/8"	1,838
1-3/16"	1,287	2-9/16"	4,220
1-11/16"	6,080	2-5/8"	6,965
1-3/4"	10,390	2-3/4"	1,435
2-15/16"	6,350	2-7/8"	2,362
		2-15/16"	3,200
		3"	7,546

SQUARES

B-33	
3/16"	1,379
5/16"	536
7/16"	2,988
1/2"	1,225
C-1213	
3/16"	862
9/16"	2,279
5/8"	10
7/8"	5,373
1"	19
C-1018-20	
1-1/2"	19

HEXAGONS

B-33	
5/8"	689
1"	2,154
1-1/4"	99
1-1/2"	27
C-1213	
7/16"	1,732
5/8"	6,320
13/16"	2,013
1"	49
1-1/16"	480
1-1/8"	1,515
1-3/16"	1,381
1-3/8"	1,456
1-1/2"	3,848

FLATS C-1018-20

1/8	x 1-1/4	1,440	5/16	x 2	796	1/4	x 4	1,229
	x 2	3,230		x 4	1,652		x 6	3,508
	x 2-1/4	42		x 6	1,213	5/16	x 1-1/2	1,934
	x 2-1/2	2,187	1/4	x 1-1/2	466		x 2	3,027
	x 3-1/2	3,907		x 1-3/4	2,130	3/8	x 1-1/2	3,574
	x 4	2,342		x 2	2,157		x 2	2,024
	x 6	66		x 2-1/2	2,700		x 4	2,045
3/16	x 1-1/2	2,111		x 3	460	1/2	x 1-1/4	4,043
							x 4	1,990

STEEL TUBING

GRADE MT-1010 RANDOM LENGTHS

SEAMLESS HYDRAULIC, ANNEALED

O. D.	Decimal Wall Gauge	Quantity in Feet
1/4"	.035	1,875
5/16"	.035	2,577
3/8"	.035	962
	.049	220
	.065	2,996
1/2"	.049	2,257
	.065	4,342
	.083	4,580
5/8"	.035	4,360
	.049	2,679
	.065	8,138
	.083	2,062
3/4"	.049	912
	.065	1,965
1"	.065	3,623

COLD ROLLED WELDED, FLASH REMOVED

O. D.	Decimal Wall Gauge	Quantity in Feet
1/2"	.035	2,686
	.049	2,182
	.065	5,000
5/8"	.035	2,935
	.049	3,092
	.065	202
3/4"	.035	8,182
	.049	5,658
	.065	6,113
7/8"	.049	3,075
	.065	6,611
	.083	80
1"	.035	5,302
	.049	6,588
	.065	2,466
	.083	2,886
1-1/8"	.049	692
1-1/4"	.035	2,748
	.065	736
	.083	2,278
1-3/8"	.035	898
1-1/2"	.049	3,435
	.065	3,721
	.083	5,417
2"	.049	3,257
	.065	3,426
	.083	2,968
2-1/8"	.083	747
2-1/2"	.065	2,991

METAL GOODS CORPORATION — GENERAL OFFICES: ST. LOUIS 15, MISSOURI

St. Louis 15, Missouri
5239 Brown Avenue
Nelson L. Hawer
Phone: GOodfellow 1234

Kansas City 16, Mo.
1300 Burlington
Frank D. Hogan
Phone: NOrclay 3516

Dallas 9, Texas
6211 Cedar Springs Rd.
Sam D. Hodgdon
Phone: ELmhurst 3271

Tulsa 3, Oklahoma
302 North Boston
Scott J. Harrison
Phone: 4-4101

Denver 2, Colorado
2425 Walnut Street
Neal Dehn
Phone: AComa 5891

Houston 3, Texas
711 Milby Street
Harris T. Gregg
Phone: CEntral 8881

New Orleans 12, La.
432 Julia Street
Carl T. Wedemeyer
Phone: CAnal 7373

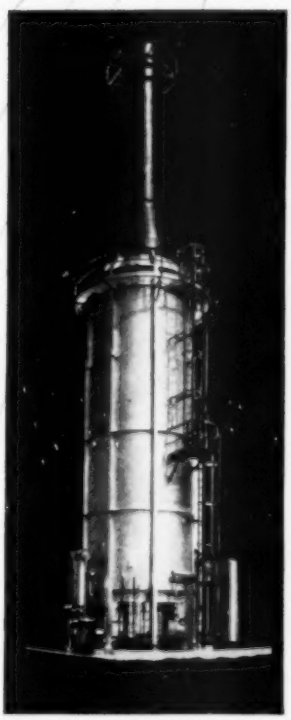
...dollar per dollar

b.t.u. per b.t.u..... .....

PETROCHEM-ISOFLOW FURNACES

are most efficient by any comparison!

BETTER HEAT DISTRIBUTION
MAXIMUM FUEL EFFICIENCY
LOW PRESSURE DROP
LOW MAINTENANCE
ZERO AIR LEAKAGE
EXPLOSION RESISTANT
MINIMUM GROUND SPACE
SHORT LENGTH OF LIQUID TRAVEL
EXCESS DRAFT FOR HIGH OVERLOAD
PLENUM CHAMBERS FOR HAZARDOUS AREAS

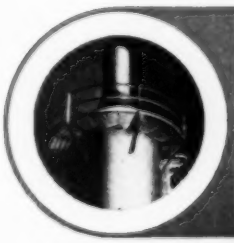


simplicity of design and construction

The Isoflow Heater basically is a circular steel shell; this results in an explosion-resistant structure. The shell is lined on the inside with insulation and insulating refractories; this results in a wall with a zero air leakage and high efficiency. The vertical tubes are combined with integral convection tubes; this results in less headers in the heaters for complete cleanability. The integral radiant convection tubes and minimum number of headers result in a minimum pressure drop for a given velocity. The vertical tubes completely shield the walls resulting in low wall maintenance. The small number of headers in combination with the vertical tubes result in ease of cleaning and, if desirable, gang-cleaning of several tubes simultaneously. Individual burners, symmetrically spaced with relationship to the tubes, results in even heat distribution horizontally. The reradiant cone effects even heat distribution vertically. Segregated burners result in ease of firing and inspection of burners. These are some of the design features which place Isoflow Furnaces in a class of their own

—most efficient by any comparison.

More than 1150 are in operation throughout the world in the petroleum, chemical and allied industries . . . for all processes and for any duty, pressure, temperature and efficiency . . . and all Petrochem-Isoflow Furnaces are pre-eminently satisfactory.



PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INCORPORATED

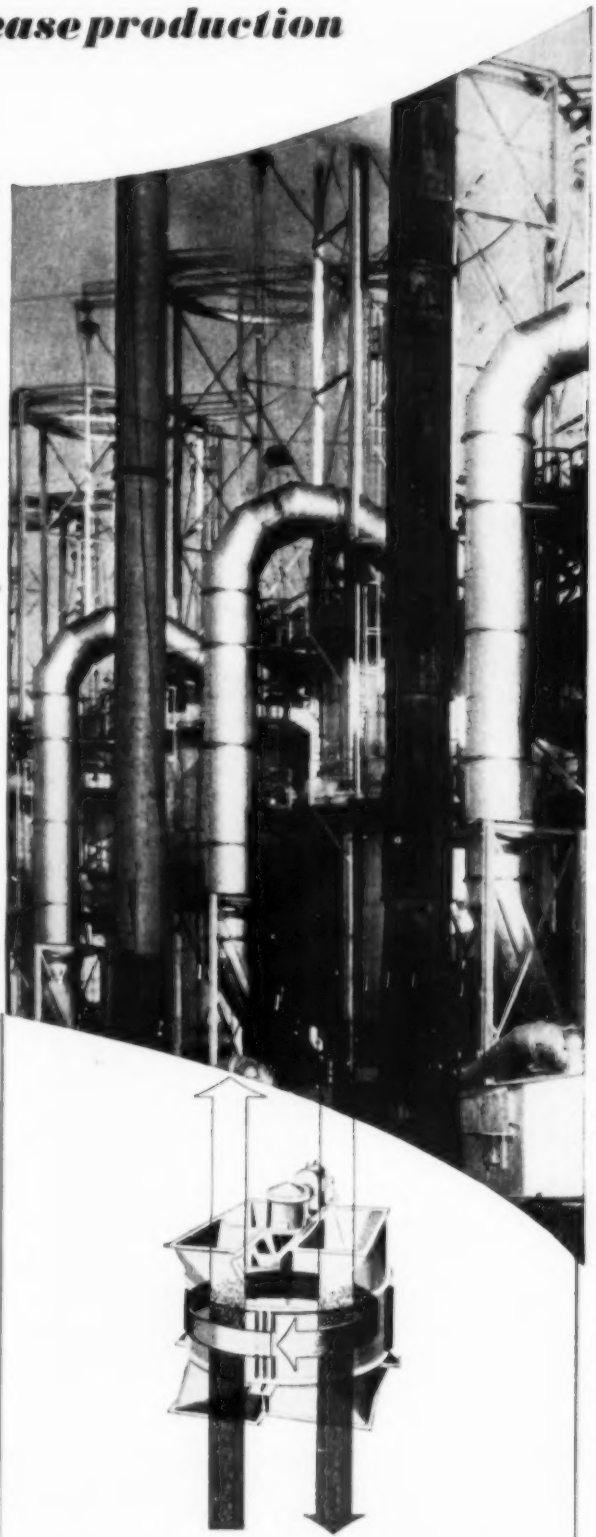
122 EAST 42ND STREET, NEW YORK 17, N. Y.

Representatives: Bethlehem Supply, Tulsa and Houston · Flagg, Brockett & Durgin, Boston · D. D. Foster, Pittsburgh · Faville-Levally, Chicago · Lester Oberholtz, California · Gordon D. Hardin, Louisville, Kentucky · Turbex Equipment Co., Norberth, Pa.

Reduce slag ... increase production

with the

Ljungstrom Air Preheater



Slag — primary cause of reduced capacity — can be practically eliminated by the use of a Ljungstrom Air Preheater.

That's because preheated air mixes more thoroughly with the fuel. Therefore, less excess air is required for complete combustion — and less combustible material is lost in the flue gases.

Thus, with a Ljungstrom Air Preheater, there is less material present in the furnace for slag production. Oil tubes stay cleaner . . . longer. Stills stay on stream *at top production* for months longer.

For example, a pipe still in an eastern refinery dropped from 16,000 barrels a day to 12,000 because of slag. Now, with a Ljungstrom Air Preheater and modern high-temperature burners, the still operates *continuously at 18,000/20,000 barrels.*

This saving alone can pay for a Ljungstrom installation in less than a year. Add it to more economical furnace design possible . . . up to 20% fuel savings . . . greater heat recovery even from low grade fuels . . . higher through-put — and you can see why the Ljungstrom Air Preheater is perhaps *the most significant guidepost to economy available today to refiners.*

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits attainable in your fuel burning equipment — call or write The Air Preheater Corporation today.

The Ljungstrom operates on the continuous regenerative counter-flow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

The Air Preheater Corporation

60 East 42nd Street, New York 17, N. Y.

WHEREVER YOU BURN FUEL, YOU NEED LJUNGSTROM

LAGONDA

delivers the goods -fast!

TUBES SWEPT CLEAR of the toughest coke with the irresistable speed of a bulldozer through brush. Through tube after tube, without let-down, the self-feeding cutter head smashes the coke and shoves it out, backed by the powerful drive of the famous Lagonda 1100 Series motor with its ball thrust bearings front and rear, and its exclusive front end lubrication. Here's a combination that is both enduring and fast.

Fast, too, in getting to the job. Let a customer tell what he thinks of Lagonda deliveries: "This is a note of appreciation for the very fine service you rendered us on our recent order. It was received yesterday, well ahead of schedule. Thanks a lot."

When you need tube cleaning, you want *speed.* Call your local Elliott-Lagonda representative, or Elliott Company, Springfield, Ohio.

ELLIOTT Company

LAGONDA DIVISION, SPRINGFIELD, OHIO

HERE'S VALUABLE TUBE CLEANING DATA.

Bulletin Y-34 is crammed with facts on cutting down time in cleaning still tubes. On request.

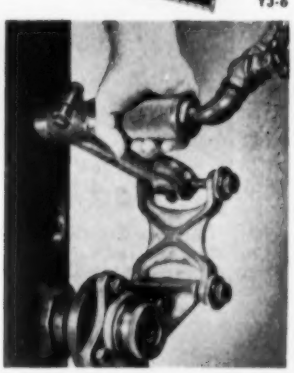
Y3-6

Some other Lagonda products:

AUTOMATIC SIGHT FEED LUBRICATOR for pressure service. When pressure is on, lubrication starts. When pressure is shut off, lubrication stops. Simple and positive.

FOOT-OPERATED THROTTLE VALVE enables operator to handle tube cleaner with both hands, controlling pressure with his foot, like an auto accelerator.

CATALYST CLEANER. Removes spent catalyst from tubes, without permitting its escape. Also good in removing fly ash from the tubes of air preheaters.



HANDHOLE SEAT GRINDER. A precision tool for grinding handhole seats flat. Can save its cost on one job. Driven by air motor (electric motor optional).

NICHOLSON TRAPS UP PRODUCTION

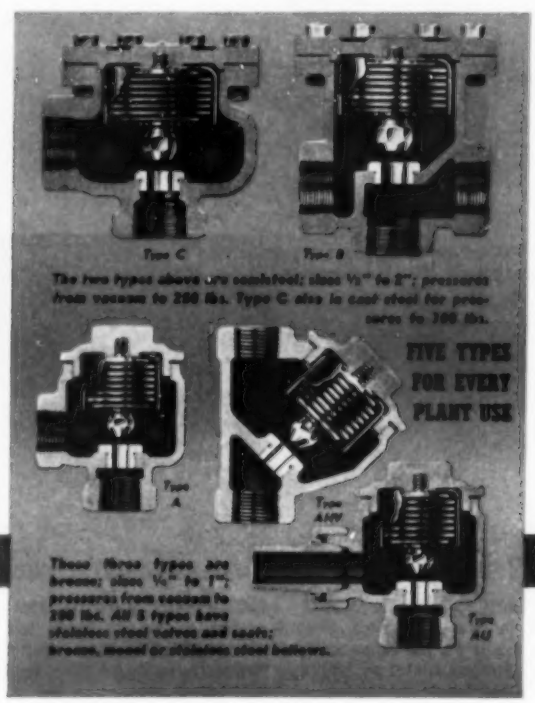
at Certain-teed Plant

Above, Certain-teed Products Corporation's Dallas, Texas, roofing plant, where Nicholson steam traps have been adopted as standard.

Why this modern Dallas, Tex., plant of Certain-teed Products Corporation has standardized on Nicholson steam traps may be important to you. It was because, as a plant official stated, "Nicholson traps have cut loss of steam and improved operations generally". More specifically, a recent survey showed these Nicholson features to be the reasons why leading plants are increasingly standardizing on Nicholson thermostatic traps: (1) Two to six times average drainage capacity. (2) Operate at lower temperature differential. (3) No air binding. (4) Freeze-proof. (5) Only one moving part. (6) No need to change valves for varying pressures. (7) Record low for steam waste. Types for every process, power and heat application.

Send for
CATALOG 751
Contains installation diagrams and data for determining proper size of trap.

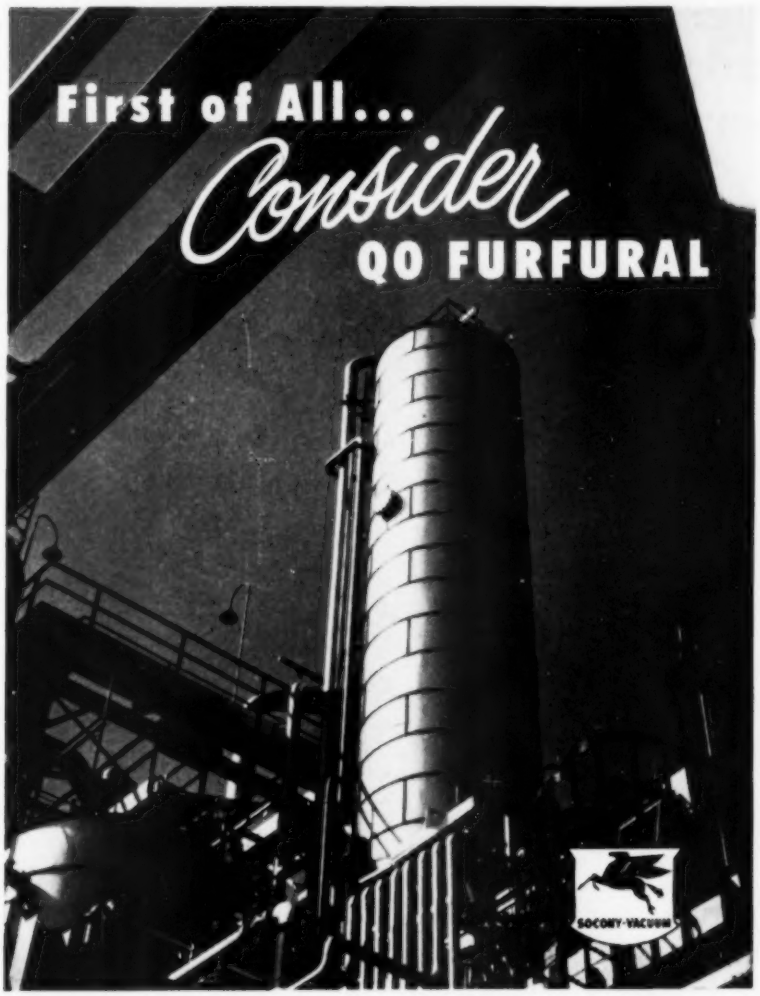
Nicholson traps on drying drums of asphalt saturator; Certain-teed's Dallas, Tex., plant.



NICHOLSON & CO.
TRAPS · VALVES · FLOATS
207 OREGON ST., WILKES-BARRE, PA.

Sales and Engineering Offices in 58 Principal Cities

for high yields of high quality oil at low cost



Furfural lubricating oil treating tower in the refinery of the Socony-Vacuum Oil Co., Inc., one of the large users of the Furfural Process.

QO QUAKER CHEMICALS ®

Furfural
Furfuryl Alcohol
Tetrahydrofurfuryl Alcohol
Furoic Acid
Fur-Ag® Conditioner
Furafil® Ligno-cellulose

If you would like to know more about furfural and its uses in the petroleum industry, a request on your letterhead will bring prompt information.

Find Out Why Leading Refiners Choose FURFURAL as a Selective Solvent

SEPARATION

Furfural is a polar molecule and gives sharp separation between the mixtures of products present in lube stocks. Its high specific gravity permits rapid phase separation.

RECOVERY

Furfural is a stable compound and may be recovered almost quantitively for reuse.

SAFETY

Furfural is easy to handle and has a safety record extending over 30 years of industrial use.

STORAGE

Furfural is shipped in tank cars and stored in steel tanks. Its low freezing point makes it easy to handle in cold weather.

AVAILABILITY

Furfural is produced the year around in large quantities at three plants from replaceable raw materials. It is low in price.

Furfural is being used in more than 38 petroleum processing plants throughout the world. Most of these are designed for refining lubricating oil, but other petroleum fractions are being successfully treated with furfural.

QO QUAKER CHEMICALS

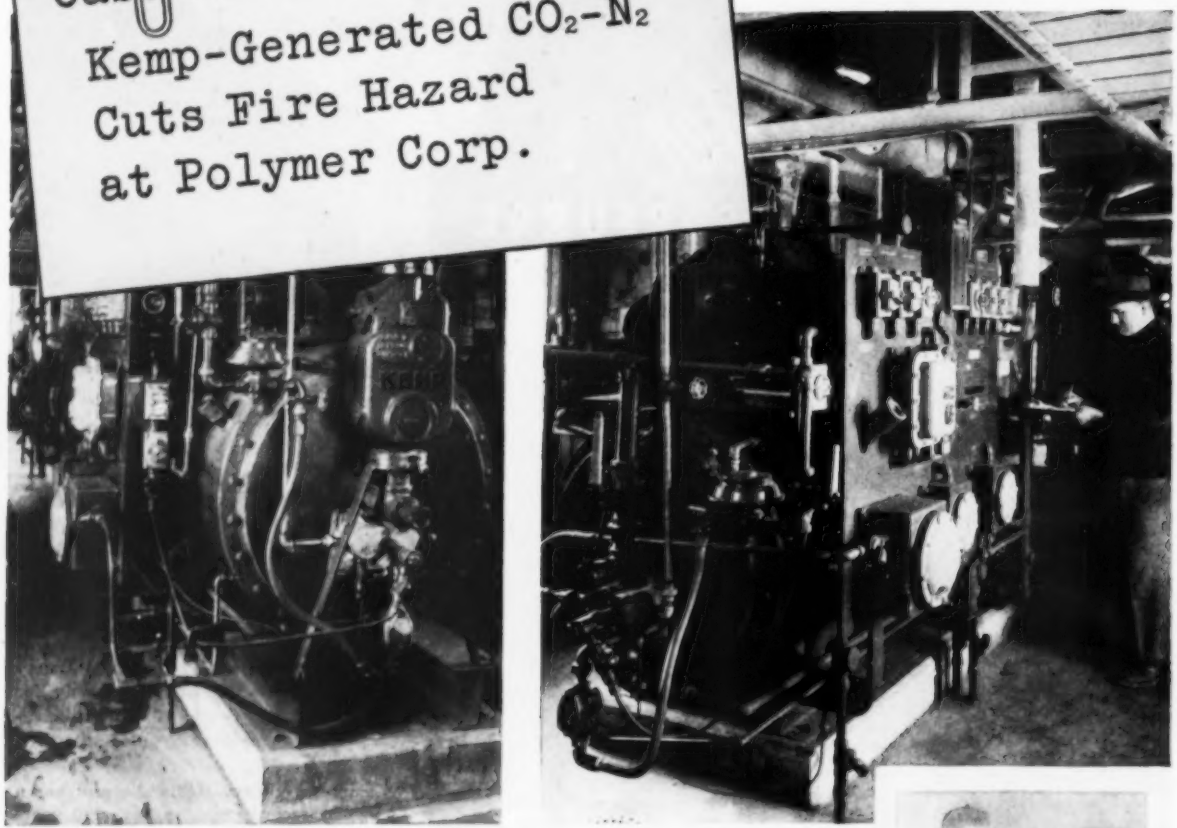
The Quaker Oats Company CHEMICALS DEPT.

3408 The Merchandise Mart, Chicago 54, Illinois
Room 5408, 120 Wall St., New York 5, N. Y.
Room 4408, P. O. Box 4376, Portland 8, Oregon

In the United Kingdom: Imperial Chemical Industries Ltd., Billingham, England
In Europe: Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France
In Australia: Swift & Company, Pty., Ltd., Sydney • **In Japan:** F. Kanematsu & Company Ltd., Tokyo

Case No. 62

Kemp-Generated CO_2-N_2 Cuts Fire Hazard at Polymer Corp.



How Polymer operated day and night for 10 years at maximum safety

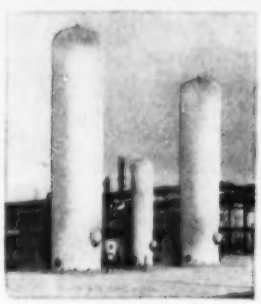
When Polymer Corporation, Ltd., Sarnia, Ontario, began operations in 1943, inventory included two Kemp MIHE Inert Gas Generators. Since that date, Polymer—and its Kemp equipment—has been operating 24 hours a day, 365 days a year. The huge quantities of man-made rubber and associated chemicals it produces—200,000,000 pounds during one year alone—reach, in one form or another, the four corners of the world.

Kemp Plays an Important Role

The high volatility of many of the ingredients used in this giant operation necessitates blanketing and purging vessels after use. It is in this step that Polymer employs Kemp Generators to assure safe, trouble-free performance. The gas they produce is piped to different operations over the entire company area—it *must* be clean! Kemp does the job—Polymer knows that it can depend on Kemp to deliver a *clean inert at a specific analysis, regardless of demand*. And every Kemp Generator is engineered for fast starts and easy operations that save *time* and *money*.

Kemp Can Do a Job for You

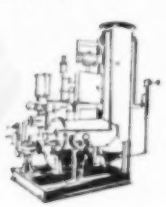
Kemp superiority is no accident. It is based on years of experience . . . on quality of design to meet specific problems. Every Kemp design features the Kemp Industrial Carburetor for complete combustion without tinkering or waste . . . for simplified installation and maintenance. Every Kemp design includes the latest fire checks and safety devices. If you have a blanketing or purging problem, contact Kemp engineers. They will be glad to study your situation and recommend the installation best suited to your needs. No obligation, of course.



Gas generator building from which inert gas is piped over 130 acres of company property at Polymer's Sarnia, Ontario, operation.

For more complete facts and technical information, write for Bulletin I-10 to: **THE C. M. KEMP MFG. CO., 405 East Oliver Street, Baltimore 2, Md.**

KEMP OF BALTIMORE



INERT GAS GENERATORS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • ADSORPTIVE DRYERS
SINGEING EQUIPMENT

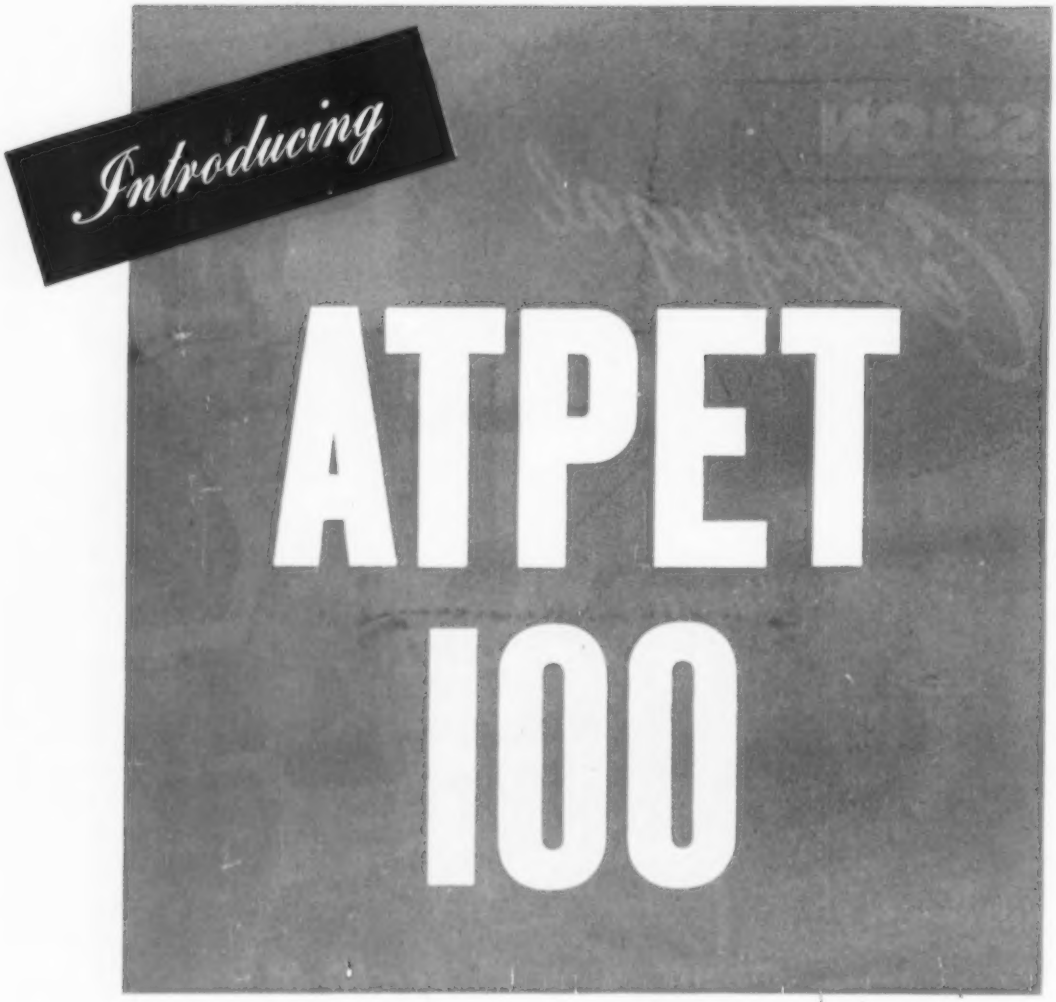
MISSION *Centrifugal* PUMPS

TYPE "D" & "E"
MISSION CENTRIFUGAL PUMPS
WITH CAPACITIES UP TO 1800 GPM,
HEADS UP TO 350' AND SPEEDS UP TO
3500 RPM. VARIOUS TYPES CORROSION-
RESISTANT ALLOYS AVAILABLE.
FURNISHED WITH PACKING OR
MECHANICAL SEALS.

The design of Mission Centrifugal Pumps combines the features of LONG LIFE and EASY MAINTENANCE with years of dependable performance . . . whatever your pumping requirements may be. Let us give you further details and specific applications. Write us specifying discharge and suction head . . . capacity . . . material to be pumped . . . specific gravity . . . temperature . . . viscosity . . . and any special conditions.

Humble Road, P. O. Box 4209, Phone MUlberry 5561
Export Office: 30 Rockefeller Plaza, New York
Handled by representatives in all industrial areas . . .
and by supply stores in every oil country.

MISSION MANUFACTURING CO.
HOUSTON, TEXAS



...a new non-metallic corrosion inhibitor

ATPET 100 makes engine preservatives, slushing oils, and other corrosion preventive compounds form a tougher, longer lasting bond to metals . . . gives greater protection against rusting. ATPET 100 is versatile; gives good protection in diesel fuels and fuel oils.

ATPET 100 is always uniform from shipment to shipment.

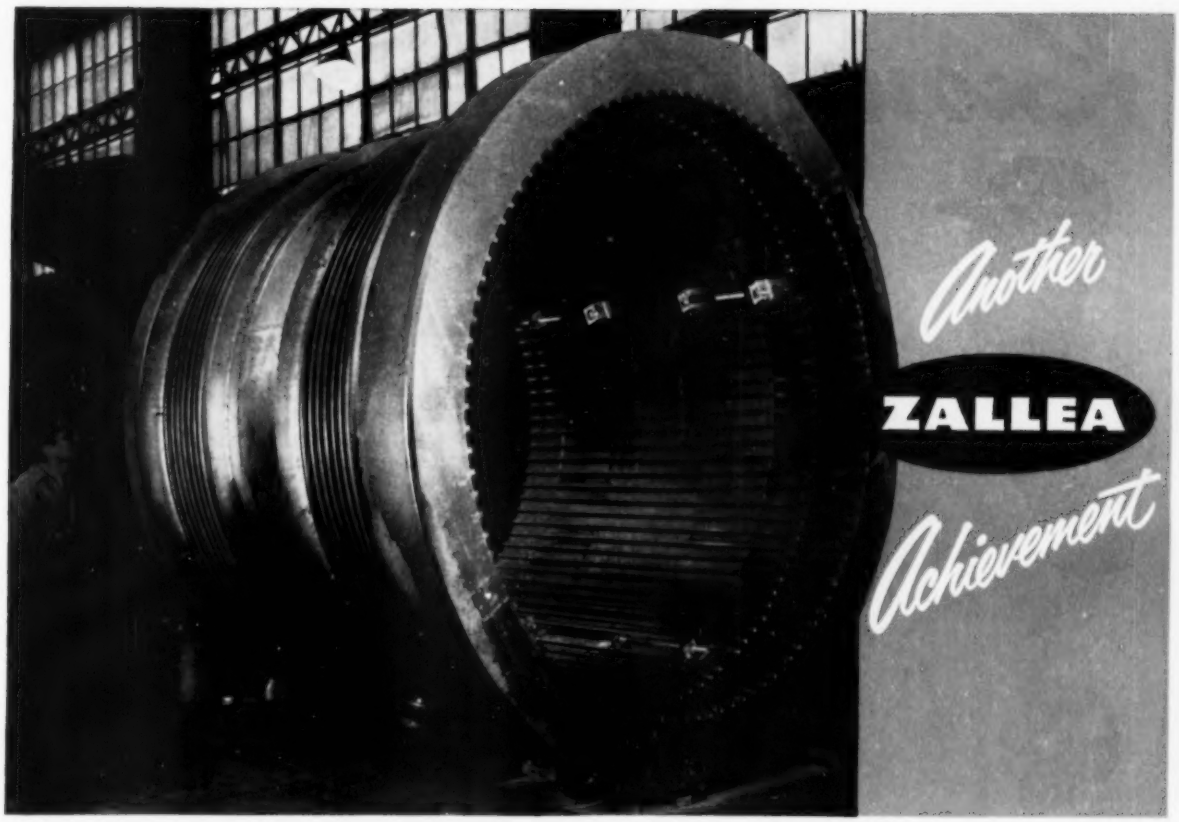
ATPET 100 is highly effective: gives improved protection even in small concentrations.

ATPET 100 protects longer: HBr and humidity exposure tests show that ATPET 100 protects far longer than other inhibitors.

ATPET 100 is economical, too. For samples, technical data and prices... *write or call Atlas today.*

ATLAS
INDUSTRIAL CHEMICALS DEPARTMENT
ATLAS
POWDER COMPANY
WILMINGTON 99, DELAWARE

Offices in Principal Cities • Atlas Powder Company, Canada, Ltd., Brantford, Canada



In the almost quarter century that we have been in business, we have been called upon to develop and produce many highly specialized types of expansion joints. None, however, have been more spectacular than the 109-inch joints recently developed for use in testing equipment for aircraft engine prototypes. These low pressure joints were designed with a hundred internal tie bars, which permit the joints to absorb the lateral deflection between a long exhaust header, operating at 650° F. and a series of large gas coolers, without the need for heavy anchors. Eight of these joints are now in service in a classified defense project.

This is just another example of how Zallea engineers, with the experience gained from specializing in one product—expansion joints, are able to successfully and economically solve the most difficult problems confronting this type of industry.

But this is not all—we regularly manufacture a complete line of expansion joints capable of service in virtually any type of expansion application. These joints are available in diameters from 3 inches to 30 feet for temperatures from sub-zero to 1600° F. . . . for pressures from vacuum to 300 psi in standard designs and up to 2,000 psi in special designs.

For full details regarding your expansion joint problems or requirements, just get in touch with us. Zallea Brothers, 890 Locust Street, Wilmington 99, Delaware.

For detailed information on
Zallea Expansion Joints and services
write today for a free copy of Bulletin 351.

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

Know the pitch!

Specify **SCOVILL** PHOSPHORIZED

ADMIRALTY HEAT EXCHANGER TUBES

With Scovill men and methods on your team, you will get plenty of practical, helpful "signals" to long-life heat exchanger tube performance.

Scovill Phosphorized Admiralty Tube (Alloy 363), for example, is *made* differently... hot extruded from CONTINUOUS-CAST billets. As a result, it is *always* uniform in composition and temper; inhibitor content (phosphorus) is *always* at optimum percentage. Such tube shows superior resistance to corrosion and dezincification, especially where contaminated fresh, salt, or brackish waters are used in the circulation system.

Equally important, Scovill provides what many consider to be the most competent and comprehensive Heat Exchanger Tube Technical Service in the field. We make it our business to see that you get the right tube for your application and conditions... selected from the wide range of heat exchanger tube alloys we produce.

Inquiry and an outline of your needs are encouraged. Write on your business letterhead for our 40-page heat exchanger tube booklet. Scovill Manufacturing Company, 99 Mill Street, Waterbury 20, Conn.

SCOVILL
HEAT EXCHANGER TUBE ALLOYS

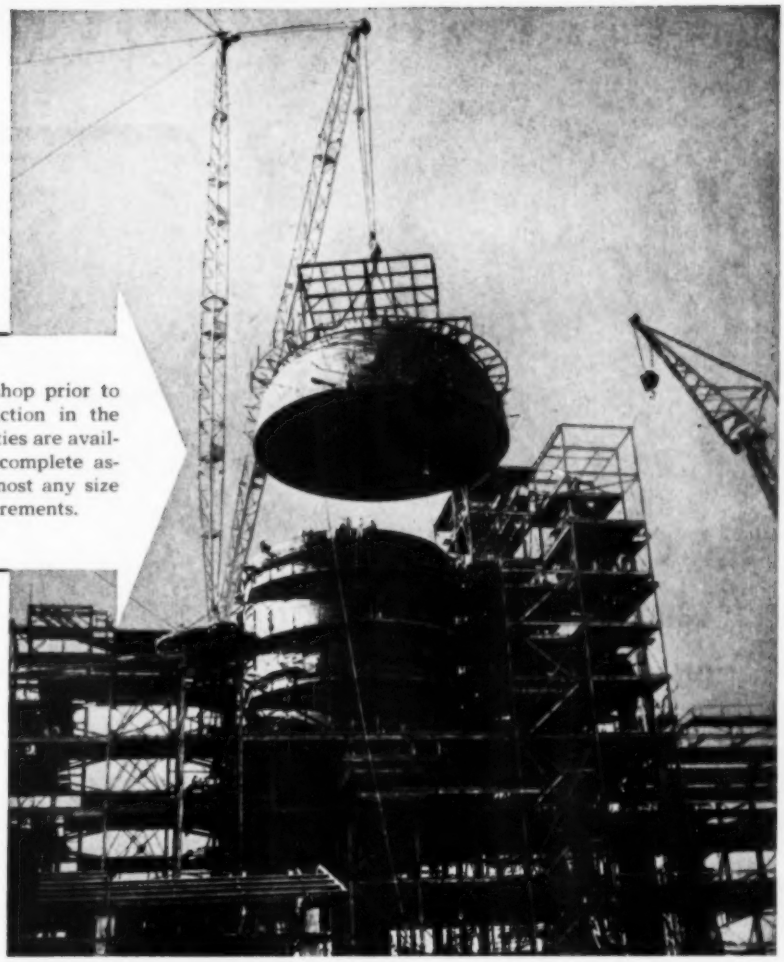
•

PHOSPHORIZED ADMIRALTY
ADMIRALTY
ARSENICAL ADMIRALTY
MUNTZ METAL
NAVAL BRASS
RED BRASS, 85%
DEOXIDIZED COPPER
ARSENICAL COPPER
COPPER NICKEL, 10% & 20%
CUPRO-NICKEL, 30%
CUPRO-NICKEL, 30% (High Iron)
ALUMINUM BRASS
ALUMINUM BRONZE, 5%
DUPLEX TUBE

SCOVILL

89C93

"You can't buy better Brass"



Precision assembly in the shop prior to shipment expedites construction in the field. Cranes and other facilities are available at Newport News for complete assembly of weldments of almost any size to meet the customer's requirements.

Shipbuilder "launches" new vessel

It's a pressure vessel in an overseas petroleum refinery. And it caps *sixty-seven* years' experience by the Newport News Shipbuilding and Dry Dock Company. Sixty-seven years, building just about any kind of vessel you could name. And at a price.

They've fabricated millions of tons of steel. They handle weldments in almost any size or shape. They machine, weld and stress relieve.

Another development: fabrication of corrosion-resistant alloy, clad, and other special steels. You know how important they are today.

What's more, there's plenty of equipment – foundry, machine shop, fabrication and erecting – to build anything from a cat cracker to a bubble tray. And enough engineering skill and shop force experience to handle the job as you want it done. And at reasonable cost.

It would pay you to ask yourself, "What could Newport News build for us?" Find the answer in the brief, easy-to-read, photo-and-caption pages of *Facilities and Products*. See for yourself what Newport News is doing. And what equipment they use.

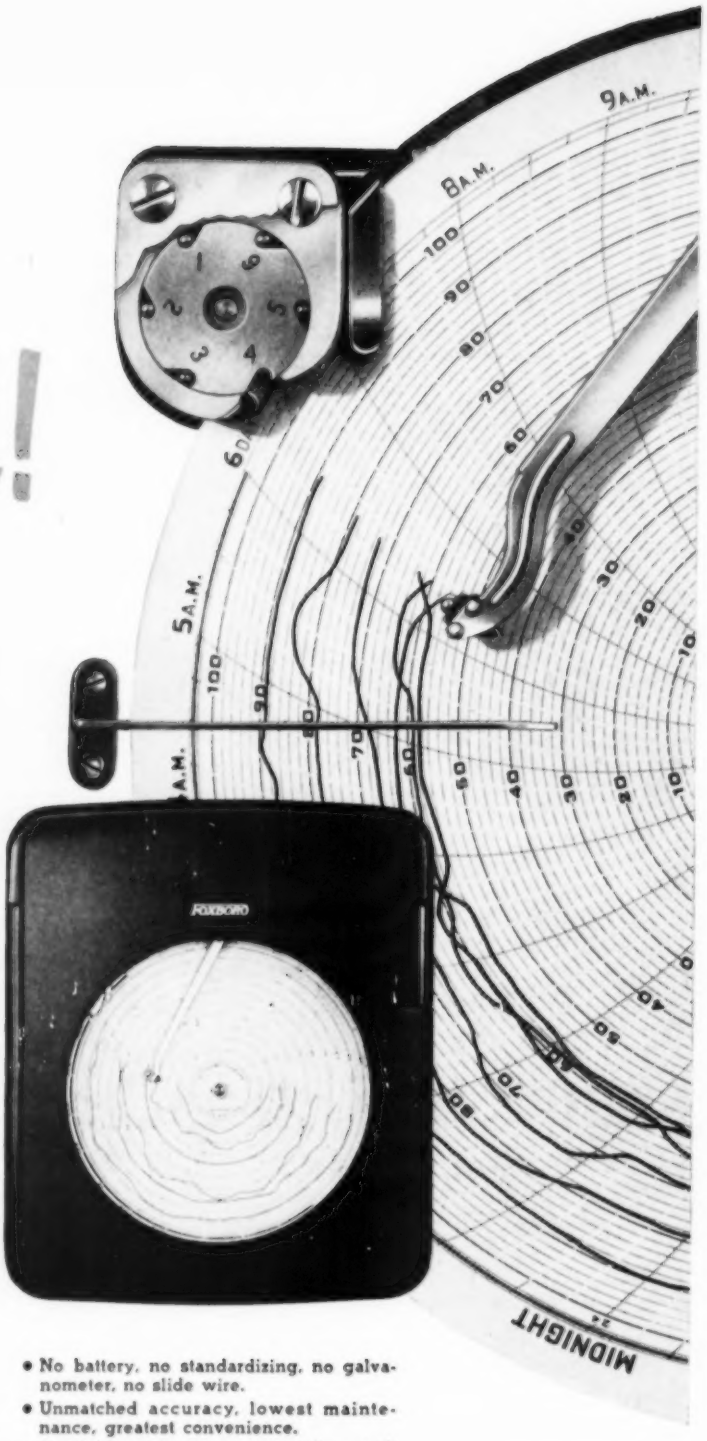
Send for *Facilities and Products*, free, today!

NEWPORT NEWS

SHIPBUILDING AND DRY DOCK COMPANY
Newport News, Virginia

What a record!

...6 Color-coded Temperature Records on one ROUND Chart



THE MULTI-RECORD *Electronic* DYNALOG*

What convenience! What economy! You can record up to 6 related temperatures on a single *circular* chart with this Foxboro Multi-Record Dynalog. Not only saves panel space, but simplifies comparison of records. There's only one pen arm — yet all 6 records appear in different, distinctive colors. Bulletin 427-1 tells the complete story. (Bulletin 444 describes the Multi-Record *Pneumatic* Receiver). Write for your copy. The Foxboro Company, 7410 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U. S. Pat. Off

Check these outstanding features

- High speed recording — only 6 seconds between prints for quick detection of process variations.
- Uses convenient, low cost circular charts.
- Each record line has its own distinctive, non-smudging color.
- No battery, no standardizing, no galvanometer, no slide wire.
- Unmatched accuracy, lowest maintenance, greatest convenience.
- Available with alarms or on-off control.
- Thermocouple or resistance-bulb types.

FOXBORO REG. U. S. PAT. OFF. — MULTI-RECORD DYNALOG

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

NEW test-tube triumph

for Vaporsealing Rigid Insulations

SPRING-KOTE® NO. 11T

Laboratory born and bred, Spring-Kote No. 11T provides complete protection for all types of rigid insulations. Precise selection and testing of raw materials, coupled with constant laboratory control of formulation, give Spring-Kote unique uniformity from batch-to-batch and shipment-to-shipment. You always can rely on Spring-Kote.

This effective spray-on protection makes your insulations impervious to moisture, wind, and rain. In addition, Spring-Kote No. 11T provides corrosion protection for metal retaining wires and jacket clamps—resists the attacks of chemical fumes and most acids. Spring-Kote No. 11T can be applied indoors or outdoors; retains form and efficiency at temperatures ranging from —40° F. to +450° F. Insulation should be thoroughly cured but an exclusive additive present in Spring-Kote permits application to damp surfaces with perfect bonding assured.

Spring-Kote No. 11T is only one of a complete line of protective coatings designed to cut maintenance and operating costs . . . write today for the complete story of Spring-Kote insulating, corrosion-proofing, vaporsealing, and waterproofing mastics. Easily applied Spring-Kote is your short-cut to better maintenance at lower cost.

SERVING INDUSTRY FOR OVER 35 YEARS

SPRING PACKING CORPORATION 332 South Michigan Avenue • Chicago 4, Illinois

REQUIRE PRECISE TEMPERATURE CONTROL?

Thermo Electronic TEMPERATURE CONTROLLERS

provide
NULL BALANCE ACCURACY
ELECTRONIC SENSITIVITY
AND SPEED

AT LOW COST

Now, with Thermo Electronic Controllers, thermocouple and resistance bulb types, you can afford accurate, automatic temperature control on processes and equipment operating between −100°F and 3000°F. The two-position control action is continuous and high speed, only one part—a magnetic control relay—moves positively when the process calls for a change of heat. Both types of controllers incorporate a null balance circuit for high measuring accuracy with an electronic control system for sensitivity and speed. Calibration is guaranteed to within plus or minus ¼ of 1% of full scale range. Bright signal lights indicate temperature conditions and are clearly visible over wide angles and great distances.

Outstanding features of Thermo Electronic Controllers are simplicity of design and sturdy and compact construction. They are easy to install, economical to operate, and require little maintenance. Severe vibration or mechanical shock will not affect the measuring accuracy or control sensitivity.

TELL US ABOUT YOUR TEMPERATURE CONTROL PROBLEM OR WRITE FOR

Thermocouple Pyrometer Controller Bulletin 50 X
Resistance Bulb Controller Bulletin 55 X

OTHER THERMO ELECTRIC PRODUCTS

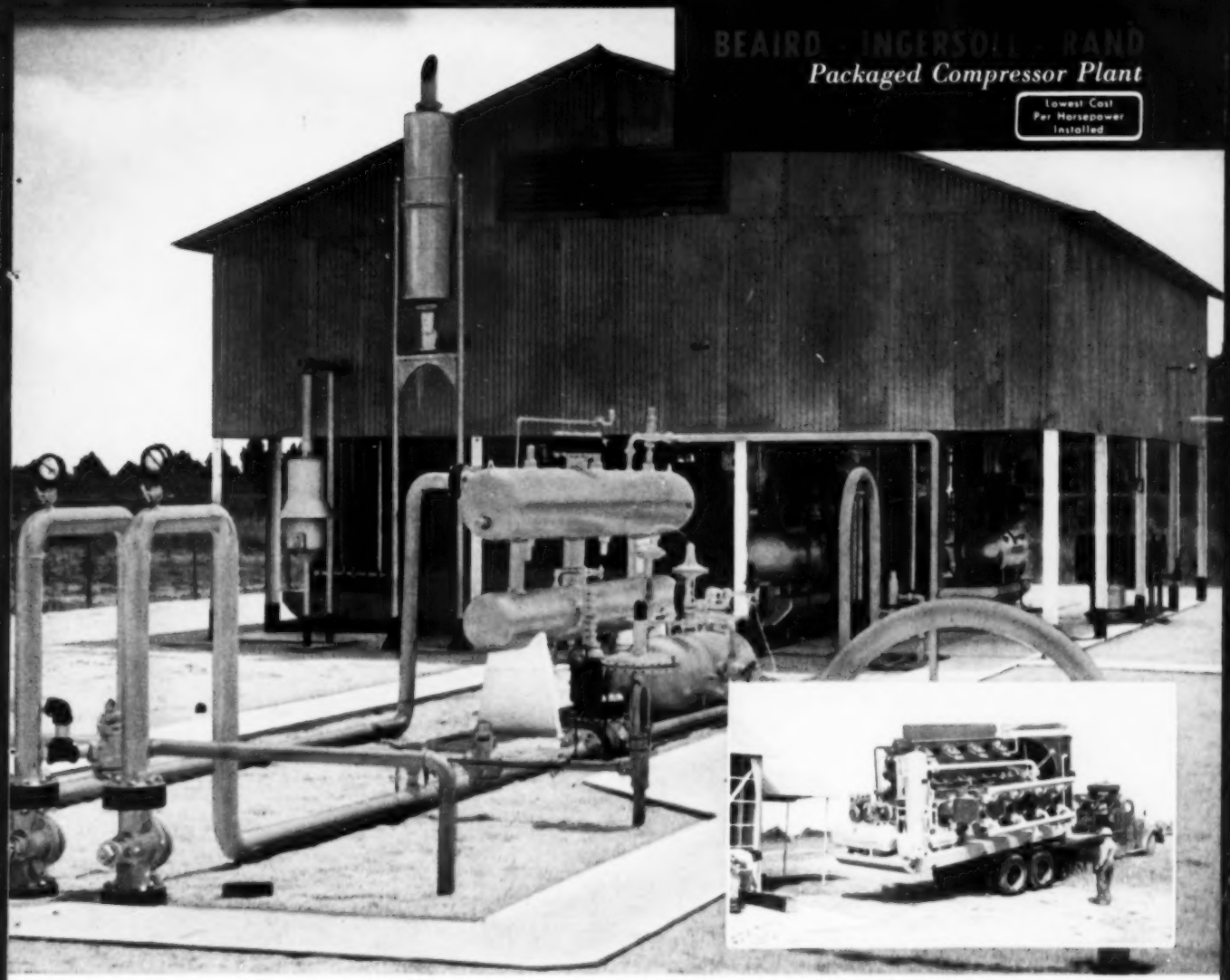
Thermocouples
Protection Tubes
Quick Coupling Connectors
Thermocouple and Extension Wires
Resistance Bulbs
Connector Panels

Thermo Electric Co., Inc.
FAIR LAWN NEW JERSEY

BEAIRD · INGERSOLL · RAND

Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



These two compressor plants were packaged at the Beaird factory and delivered as fully assembled units. Each is complete with Ingersoll-Rand gas engine-driven compressor. Young radiator and all other components normally found in compressor stations. Other sizes are made from 110 h.p. to 550 h.p.

R. E. SMITH has gas wells in Carthage Field, Texas, which, a few years ago, began dropping below gathering line pressures. To maintain required pressures, the company installed a 220 horsepower Beaird-Ingersoll-Rand packaged compressor plant. This handled the job easily until last year when other wells were tied into the station. So they installed a 440 horsepower packaged compressor in addition to the first unit. For the present, the larger compressor is all that is required, but as well pressures drop further the first unit will be put back into operation. Both packaged compressors are so designed and their compression cylinders so sized that they will continue to handle the load down to the lowest well head pressure.

Let us tell you about the economy of using single or multi-unit installations of Beaird-Ingersoll-Rand packaged compressor plants.

Maintain Gas Production —

TWO PACKAGED COMPRESSORS HANDLE DECLINING WELL HEAD PRESSURES

THE J. B. BEAIRD COMPANY, INC.

SHREVEPORT, LOUISIANA

BEAIRD SHREVEPORT

MACHINING MANUFACTURING STEEL WAREHOUSE

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

BEAIRD Pressure Storage Tanks

Engineered For Safe Storage

Now ALL Beaird Tanks are X-rayed

You know the advantage of having all shell seams on pressure tanks X-rayed. And now that is standard practice on all our large LP-Gas and anhydrous ammonia tanks — not just spot X-raying — but complete X-raying of entire shell seams. For example, on each 30,000-gallon tank, over 200 separate films are exposed, developed and individually inspected. With these films, our inspectors can literally see through every inch of seam on the entire shell. They know the welding is sound.

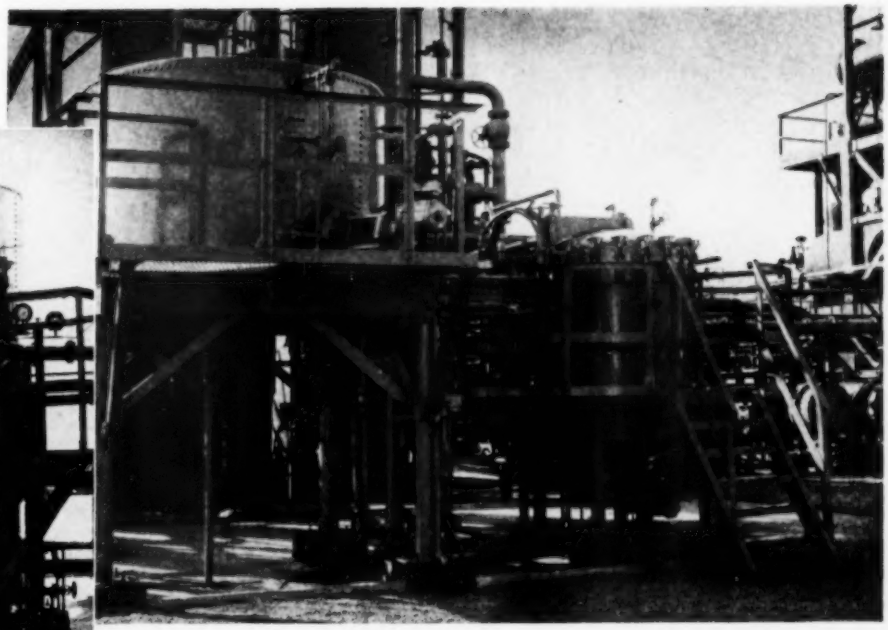
That is why we have gone to the expense of installing the most modern radiographic equipment — to assure you that the Beaird tanks you receive are engineered and manufactured for safe storage.

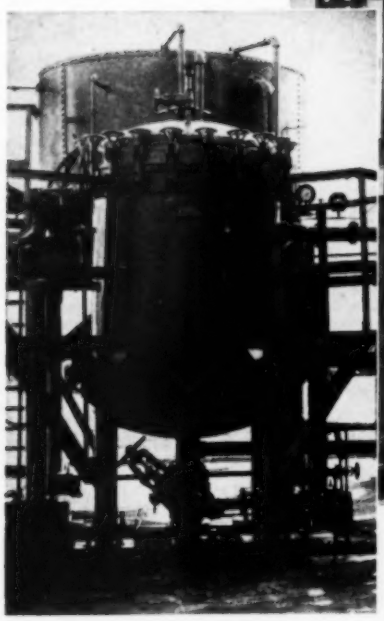
Let us quote you on your pressure storage requirements.

THE J. B. BEAIRD COMPANY, INC.
SHREVEPORT, LOUISIANA

BEAIRD

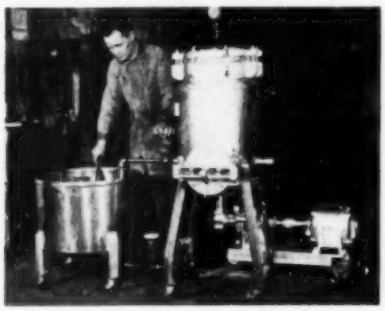
MACHINING MANUFACTURING STEEL WAREHOUSE





NIAGARA FILTER in refinery service removes troublesome iron sulfide particles from recycled solutizer solution. The filter permits this solutizer plant to operate uninterruptedly 64 hours at a time.

CLARIFY 2,000 BPH in fully-enclosed, all-metal, corrosion-resistant filter



YOU CAN TEST modern pressure-leaf filtration, under controlled conditions, with accurate scale model Niagara pilot plant filters, for rent in various sizes and styles.

If you want to remove minute solid particles from recycled streams or other liquids, consider what a Niagara Filter will do for you.

It removes all micronic particles from liquids, at flow rates as high as 2,000 BPH per filter unit. It discharges solids rapidly, for disposal or recovery in dry or slurried form. It is easily applied to continuous or batch operations. *You save labor, construction cost.*

Usually, only ten minutes are needed to remove solids at the end of each cycle. One man does the job easily without help, because there are no cloths or heavy units to remove, handle, and replace.

You save on first cost, too, by specifying Niagara for corrosion-resistant service. The filter is all-metal, totally-enclosed, leakproof. The simple all-welded tank is easily constructed to specification, in steel or a wide choice of alloys. Jacketing and synthetic linings can also be furnished, at extremely low cost for this type of equipment.

To get a fuller idea of how Niagara Filters can save you process time and cost, write today for catalog information.

FOR YOUR FILTRATION FILE . . . *Complete new 20-page catalog illustrates and describes principles and methods of pressure-leaf filtration; lists typical applications; fully describes the many sizes, styles and modifications available in the Niagara line; and details five filtration services available to you. Send the coupon for your copy today.*

Niagara Filters DIVISION
AMERICAN MACHINE AND METALS, INC.

Dept. PR-1053, East Moline, Illinois

IN EUROPE: **Niagara Filters Europe, Post Box 1109, Amsterdam-C, Holland**

NIAGARA FILTERS Division, American Machine and Metals, Inc.
Dept. PR-1053, East Moline, Illinois
Please send, without obligation, Catalog NC-1-53.

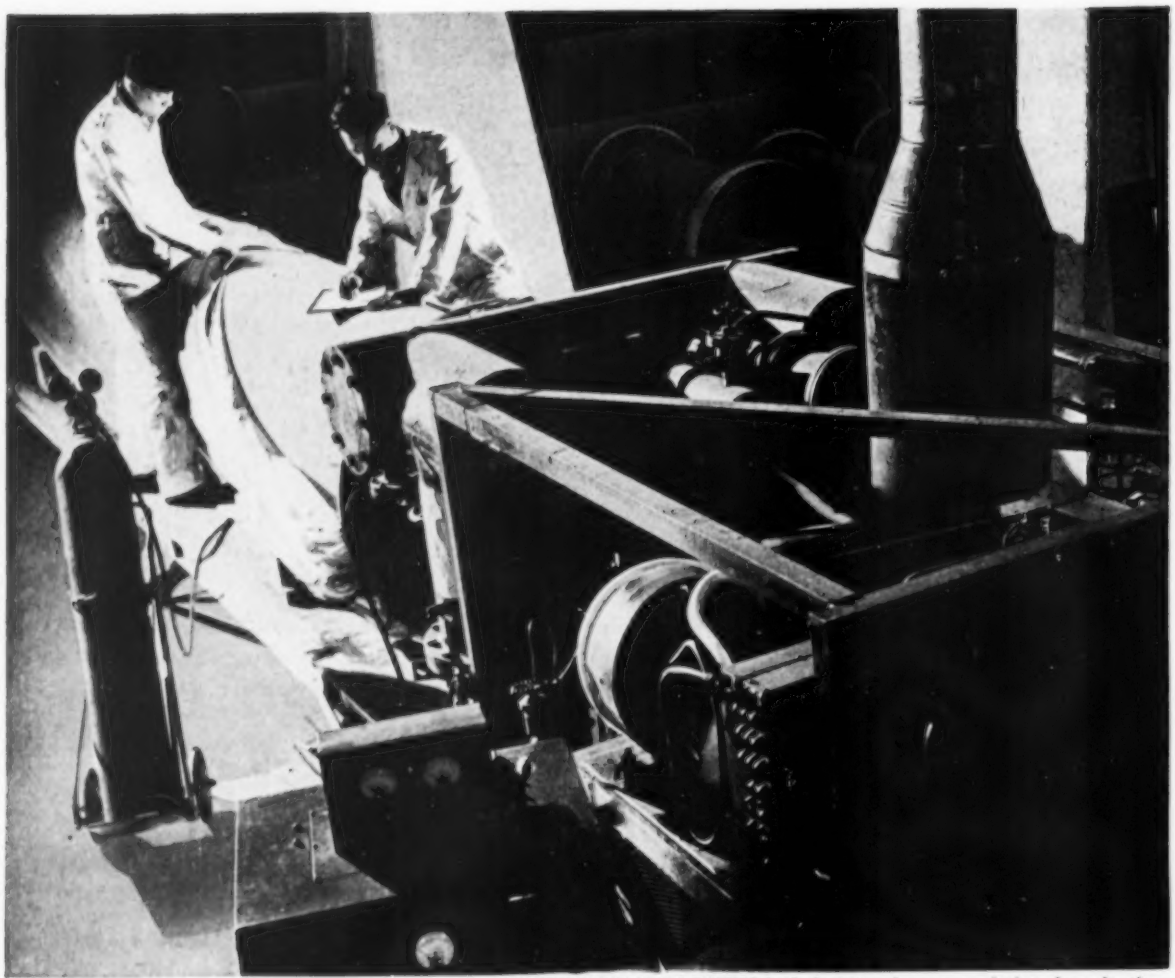
Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____



ALCO'S SPECIAL FACILITIES include not only custom-designed production machinery but also the most modern equipment for testing and inspection. Here, for example, Alco technicians use a mass spectrometer to inspect pipe welds for microscopic leaks. The mass spectrometer can detect leaks that would allow only one drop of water to escape in 100 years.

CHANCES are that new demands in your industry have presented you with many problems calling for new and varied types of heavy metal equipment.

If so, take a tip from scores of power and processing companies the world over—*look to Alco for the answers.*

Alco has the facilities required to fabricate heavy metal equipment for almost any purpose (see examples on these pages). Equally important, Alco has the wealth of experience required for the design of that equipment.

We invite you to contact your nearest Alco Products Sales Engineer and give him the details on your most troublesome heavy-equipment problem. He will show you how Alco can design and build the answer that will give you maximum value for your equipment dollar—now and in the years ahead.

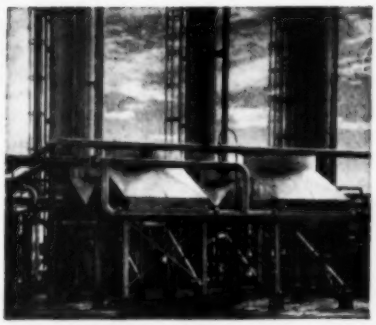
Alco Products Sales Offices are located in Dunkirk, New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa and Beaumont.

Look to ALCO for...

Answers to

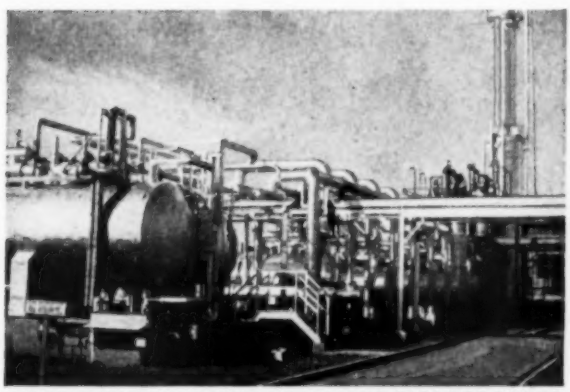
Alco

84-INCH ALCO STEEL PIPE at Croton Falls, N.Y., is part of the gigantic aqueduct system furnishing New York City with approximately 1050 million gallons of water per day. Alco Electric Welded Steel Pipe for interliners was also used in part of the New York City Board of Water Supply's new $44,000,000 East Delaware Tunnel, now nearing completion.

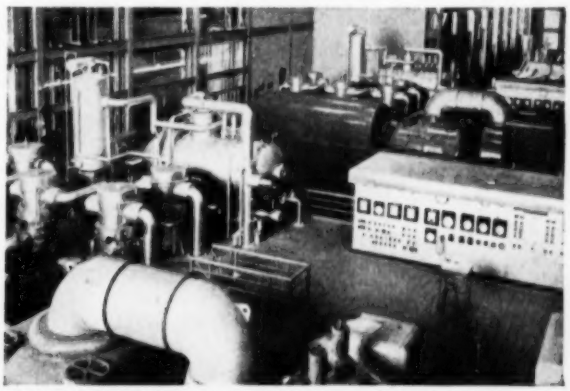


"UNI-BUNDLE UNITS" demonstrate the versatility of Alco Aircoolers. Vertical partitions welded in the headers allow several different vapor or liquid streams to be handled in a combined tube-bundle. Units are shown here at a large Southwestern natural gasoline plant; the one at right not only cools the oil but also condenses the overhead vapor from the steam.

HUGE TAR STILL, equipped with two corrugated furnaces for direct firing, typifies the virtually endless variety of heavy metal equipment built by Alco to meet special customer requirements. This is the type of equipment which has earned for Alco the confidence of power, petroleum and chemical companies all over the world.



REFRIGERANT HEAT EXCHANGERS AND STORAGE TANKS were among the variety of heavy-duty equipment built by Alco for Tennessee Gas Transmission Company's Hydrocarbon Recovery Plant at Gabe, Kentucky. Alco has over 50 years of experience in the design and fabrication of heavy-duty equipment for sub-zero operation.



ALCO FEEDWATER HEATERS AND EVAPORATORS were specified for the two 66,000 kw turbine-generator units installed in 1949 by Philadelphia Electric Company at its modern Barbadoes Island Station. Each evaporator delivers about 20,000 lb of make-up per hour. The feedwater heaters handle 555,000 lb of condensate per hour and deliver feedwater at 406 F.

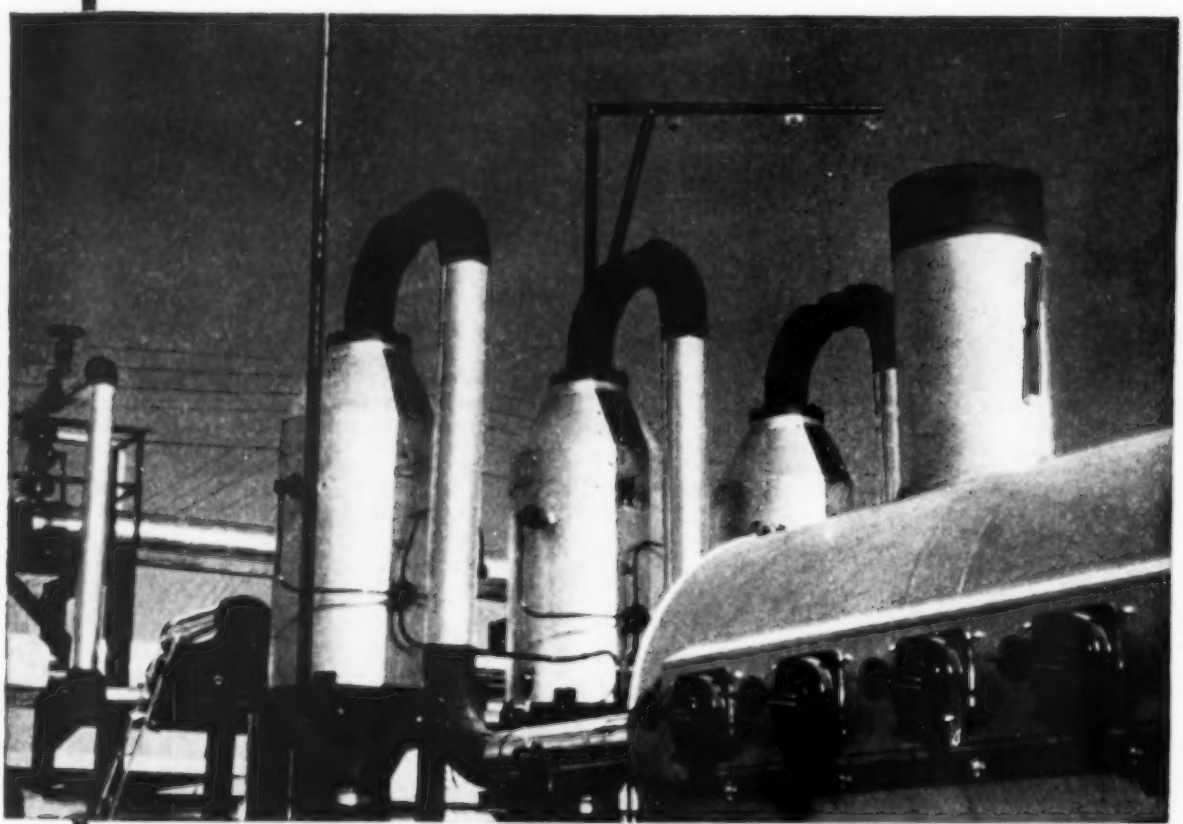
New Industrial Problems

ALCO

ALCO PRODUCTS DIVISION

AMERICAN LOCOMOTIVE COMPANY • DUNKIRK, NEW YORK

CATFORMING EXCEEDS ALL



McBride Refinery's Catforming unit at La Blanca, Texas

IN CATALYTIC REFORMING

IT'S THE CATALYST

PLANT GUARANTEES!

McBride Catformer completes initial run. Here are the startling results:

- In its initial run, all guarantees—including throughput, catalyst life, and yield octane—were exceeded.
- Starting with a 30 octane, C4 to 400 F. end point naphtha, the McBride-reformed gasoline has met final gasoline specifications throughout its entire running.
- No expensive feed preparation or product treating is required.
- The ability to regenerate the catalyst in place has been successfully demonstrated at McBride.

DO YOU HAVE YOUR COPY?

This complete bulletin tells the whole story about Catforming. Make sure you get your copy. Write The Atlantic Refining Company, Research and Development Department, P. O. Box 8138, Phila. 1, Pa. (Telephone HOward 5-2345.)

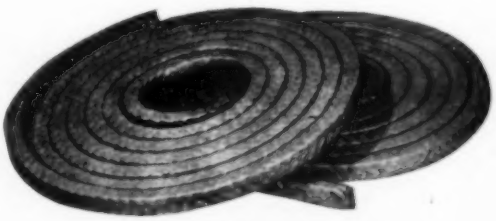
THAT COUNTS

ATLANTIC

Key packings from the

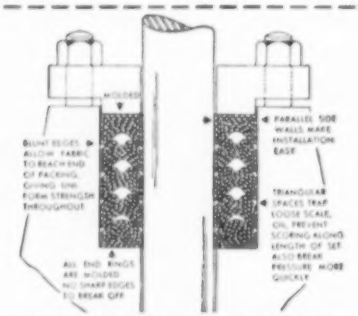
U. S. SPECIAL REFINERY PACKING

Style 251. Recommended for reciprocating rods handling acid sludge and oils not over 400 degrees F. In coil form this packing makes an excellent filter press gasket. Made with a molded channel composed of layers of high-quality asbestos, frictioned together with a compound highly resistant to liquids encountered in refinery service.



U. S. CENTRIFUGAL PUMP PACKING

Style 193. For centrifugal pumps, or other rotating or oscillating rods or shafts, handling hot or cold, fresh or salt water, oil, brine, weak acids, caustic solutions and ammonia. High-grade asbestos, thoroughly lubricated and graphited, before braiding, by an exclusive "U.S." process.

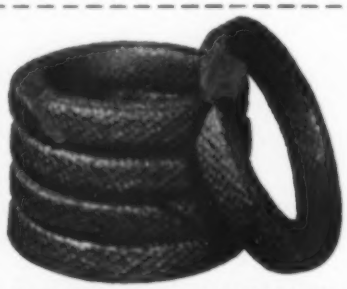

MOLDED
PARALLEL SIDE WALLS MAKE INSTALLATION EASY
TRIANGULAR SPACES TRAP LOOSE SCALE, OIL, PREVENT SCORING ALONG LENGTH OF SET ALSO BREAK PRESSURE MORE QUICKLY
ALL END RINGS ARE MOLDED NO SHARP EDGES TO BREAK OFF

U. S. MATCHLESS® PACKING

Style 16022. For hydraulic equipment, presses, rams, triplex pumps, outside packed pumps. This is the *high-pressure* packing—will withstand hydraulic pressure as high as 8000 pounds. Its self-adjusting automatic action results in reduced wear and tear on rods and plungers, minimizes friction.

U. S. BRAIDED CAUSTIC PACKING

Styles 126, 136. For reciprocating and centrifugal pump rods and valve stems handling light caustic and other corrosive solutions. Made from asbestos yarn, thoroughly treated with a special "U.S." caustic-resisting compound, and graphited. Style 126 is made in round cross-section. Style 136 is square cross-section.



U. S. RAINBESTOS HIGH-PRESSURE ROD AND PLUNGER PACKING

Style 101. For packing reciprocating or oscillating rods and plungers against high-pressure steam, air and gas up to 500 degrees F. Made from selected asbestos cloth, with a genuine U. S. Rainbow non-hardening cushion, formed square, and treated with heat-resisting lubricants and graphite.

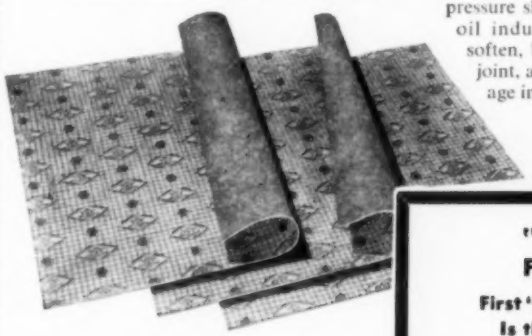
U. S. GASOLINE PUMP PACKING

Style 413. Specially designed for service against cold gasoline, mineral oils and most solvents in service on centrifugal or reciprocating rods and valve stems.

U. S. Rubber Standardized Chart!

U. S. COMPRESSED ASBESTOS SHEET

Style 899. Recommended for packing flanges or joints against super-heated or saturated steam, air, ammonia, gases, oil, gasoline, water, some acids, alkaline solutions and other chemicals. This is the original oil-proof asbestos fibre high-pressure sheet developed specially for oil industry conditions. Will not soften, burn, blow or ooze out of a joint, and does not deteriorate with age in stock.



U. S. OIL RESISTING DIAPHRAGM SHEET PACKING

In several styles, made from high-quality cotton fabric and nylon insertions with Neoprene cover stocks impervious to the action of cold oils and gasoline.

Style P-2901. Supersensitive sheet, 1/32" thick, 36" wide.

Style P-2138. Cotton sheeting insertion, in 36" width only, 1/32" thick and up.

Style P-2133. Medium wt. duck insertion, 46" wide, 1/16" thick and over.

Style P-2904. Nylon insertion in 40" widths, 1/16" thick and over.

"U. S." STANDARDIZED PACKING CHART FOR REFINERIES AND GASOLINE PLANTS

First "U. S." Packing Style Number Listed for Each Condition Is the Best Recommendation for that Particular Service

Service	Brine; Water, Cold	Water, Hot	Oil Distillates	Propane and Butane	Oil Up to 400° F.	Oil Over 400° F.	Ammonia	Caustic	Acid
Centrifugal....	193	193	413	16193	193	512	193	Weak 136 Strong 293	293
Reciprocating Steam End..	101	101	101	101	101	101	101	101	101
Fluid End....	16010	16010	16012 251	16012 251 16133	16022 251	16022 512	133	160 2 251	293
On Piston...	463	453	575	575	...	...	...	...	...
Valve Stem....	125	125	413	16193 16133	125	512	125	125	293
Gaskets.....	9	9	899	899	899	899	9	9	19069 899

Gaskets for:

Sweetland Press.....8797

Tank Car Gaskets { Bolted Type...1771 / Screw Type...4773

These packings can fill 90% or more of your packing needs for the refinery. All standard sizes and dimensions are obtainable from your supplier's stock or "U. S." District Sales Offices. And for special problems, engineers at any of our 25 branches stand ready to provide packings to fill your requirements.

U.S.RUBBER
SERVING THROUGH SCIENCE

"U.S." Research perfects it
"U.S." Production builds it
U.S. Industry depends on it.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

Is Thruput your problem?

A 30% to 100% increased thruput is no problem with Koch "Benturi" Kaskade trays. The inherent design of "Benturi" trays makes the greatest possible use of available slot energy forces. This is why almost 37% of all "Benturi" installations have been replacements for conventional bubble trays. Wire, write or phone us on the application of "Benturi" trays to your problem; no obligation.

KOCH ENGINEERING COMPANY, INC.

DESIGNERS • MANUFACTURERS • BUILDERS

321 WEST DOUGLAS — WICHITA 2, KANSAS

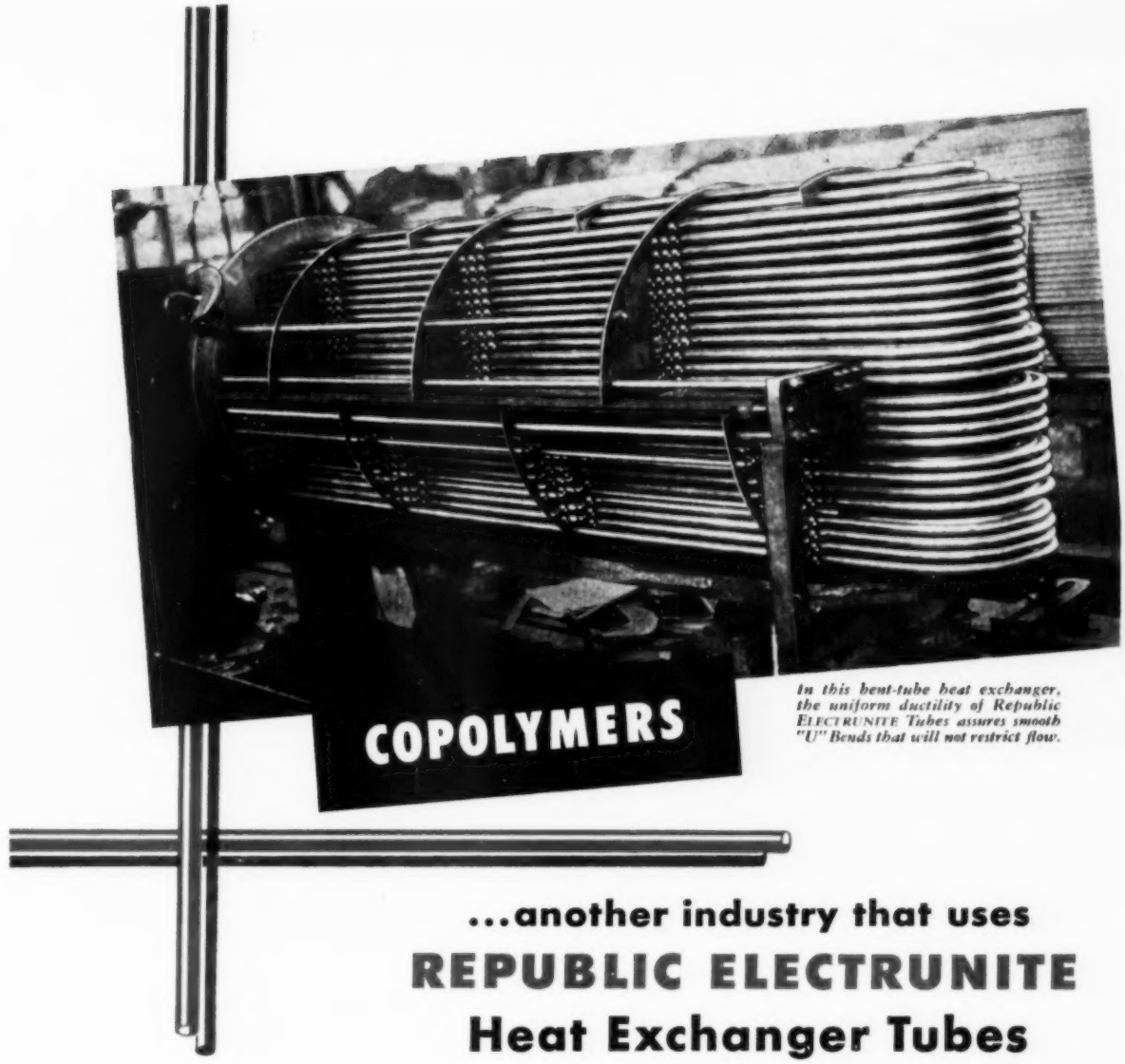
REPRESENTATIVES

Eastern and Export
30 Rockefeller Plaza
New York City

Tulsa, Okla., Repr.
Myers-Bogwell Co.
Wright Building

Pittsburgh, Pa., Repr.
D. D. Foster Co.
501 Alcoa Building

British Associates
Messrs. A. F. Craig & Co., Ltd
Paisley, Scotland



In this bent-tube heat exchanger, the uniform ductility of Republic ELECTRUNITE *Tubes assures smooth "U" Bends that will not restrict flow.*

...another industry that uses

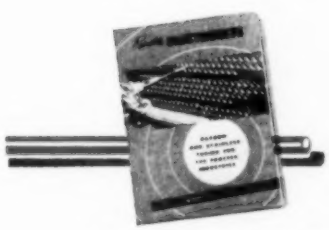
REPUBLIC ELECTRUNITE

Heat Exchanger Tubes

● At almost all stages in the production of copolymers, Republic ELECTRUNITE Tubes are used in heaters, condensers, and other types of heat exchange equipment.

The ELECTRUNITE process of making carbon and stainless electric-weld tubing from uniformly flat steel assures you of tubes that are concentric, uniform in wall thickness, and uniform in diameter all around the tube, and from end to end. Republic ELECTRUNITE Tubes can be smoothly bent even to short radii. Full-normalized treatment makes them uniformly ductile for predictable roller-expansion in the tube sheets.

Specify Republic ELECTRUNITE Heat Exchanger Tubes. Equally economical on new equipment or for retubing.



WRITE FOR "BOOKLET SPI-53" which gives useful data and specifications on Republic ELECTRUNITE Pressure Tubes, both carbon and stainless.

STEEL AND TUBES DIVISION
Republic Steel Corporation
220 East 131st Street • Cleveland 8, Ohio

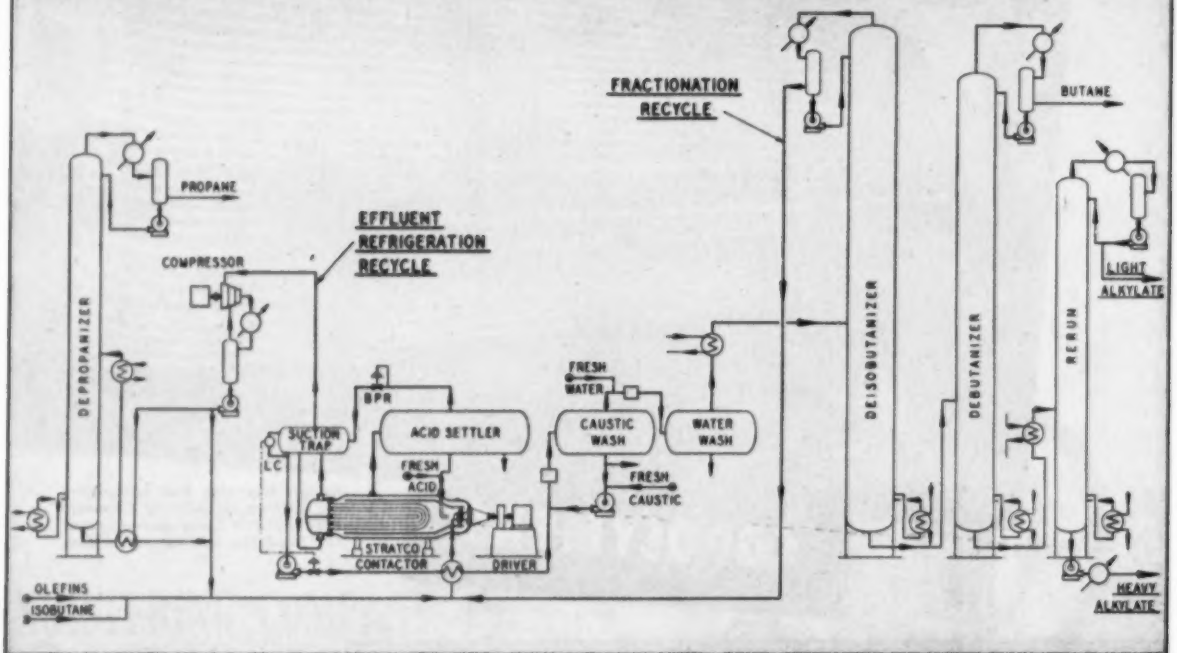
Republic
REPUBLIC STEEL
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

New

STRATCO
Reg. U. S. Pat. Off.

EFFLUENT REFRIGERATION

Reduces Fractionation in Alkylation Plants



Increases Production . . . Improves Alkylate Quality
Costs Less Than Equivalent Deisobutanizer Capacity

The Stratco Effluent Refrigeration System holds new plant investment and operating costs to a minimum, yet produces high alkylate quality and yield.

In existing plants the Effluent Refrigeration System may be applied to increase alkylate production and quality without increasing deisobutanizer capacity.

In this new Stratco process the hydrocarbon effluent from the settler is used as the refrigerant in the cooling elements of the reactor. No isobutane is evaporated from the reaction zone, therefore the Effluent Refrigeration Recycle is as effective in every way as equivalent isobutane recycle from a deisobutanizer tower.

Commercial installations now under construction

Write for complete information.

STRATFORD ENGINEERING Corporation
Dierks Bldg. *PETROLEUM REFINING ENGINEERS* Kansas City 6, Mo.

It's not the heat—it's the humidity

. . . and Alcoa Activated Alumina can change <u>that</u>!

If excess moisture is causing:

- **petroleum processing difficulties**
- **deterioration of products in storage**
- **faulty operation of instrument air lines**

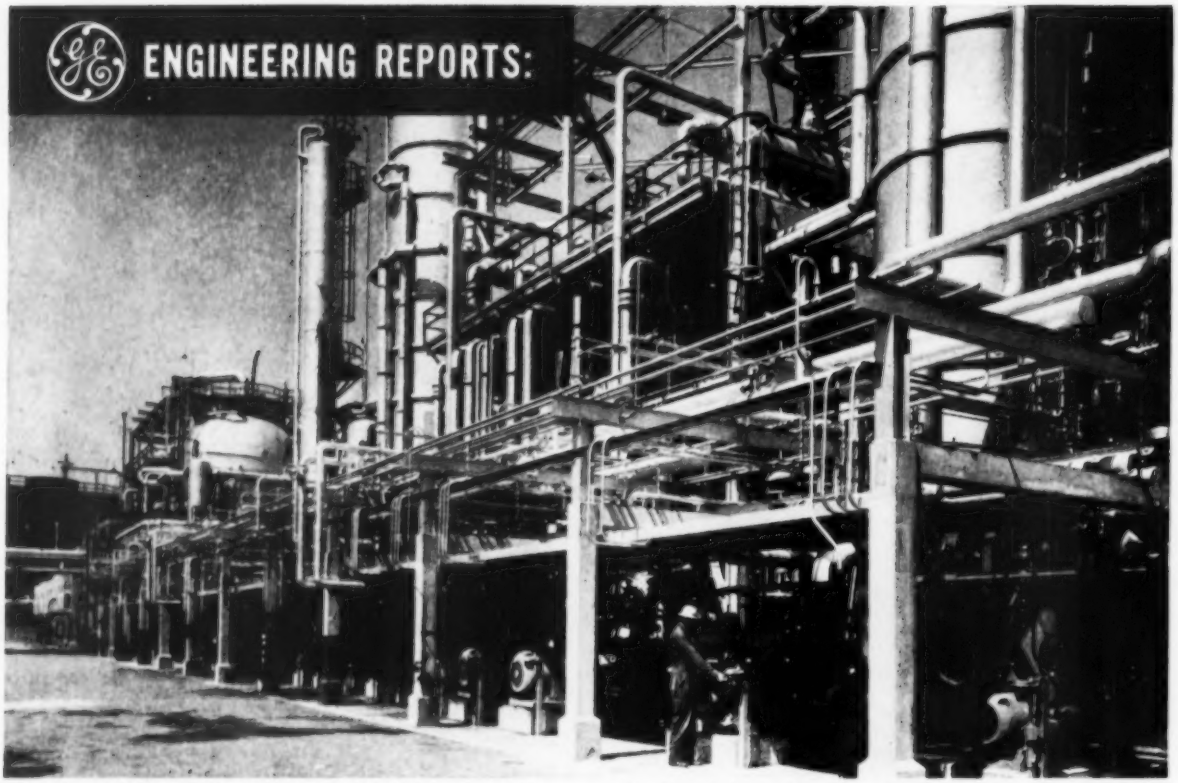
Use Alcoa *Activated** Alumina for quick, efficient dehydration of gases, liquids and vapors. It has been outstanding in these uses for more than 20 years!

There's a grade and type of Activated Alumina for *your* application too. Call your nearest ALCOA sales office today, or write: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 717-K Alcoa Building, Pittsburgh 19, Pa.

Alcoa Chemicals

ALUMINUM COMPANY OF AMERICA

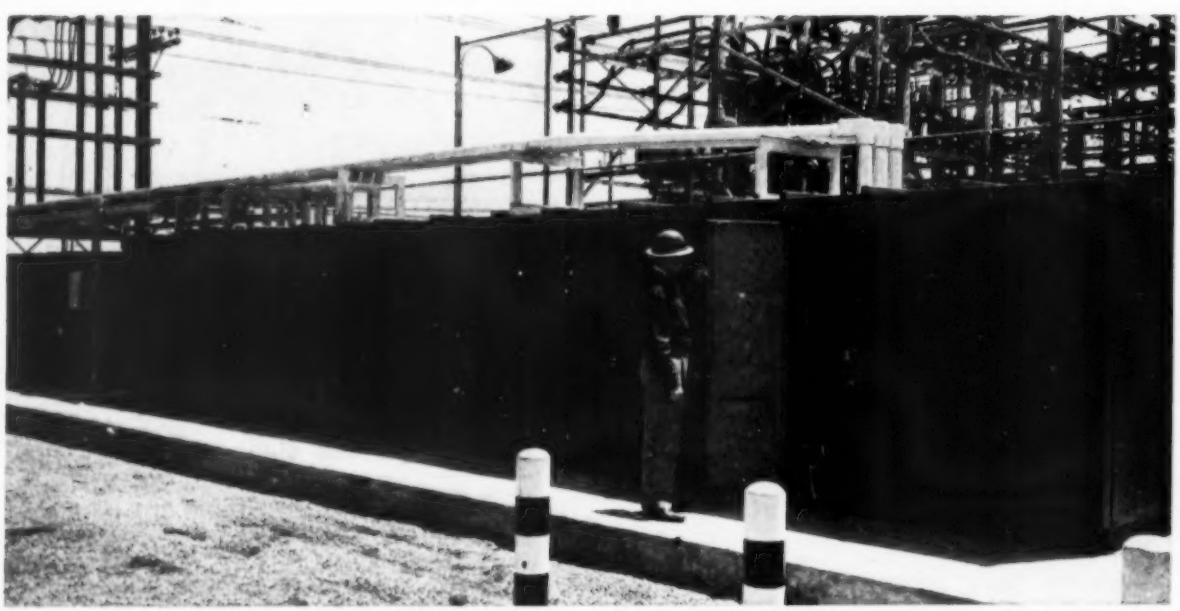
*Registered Trademark, Aluminum Company of America



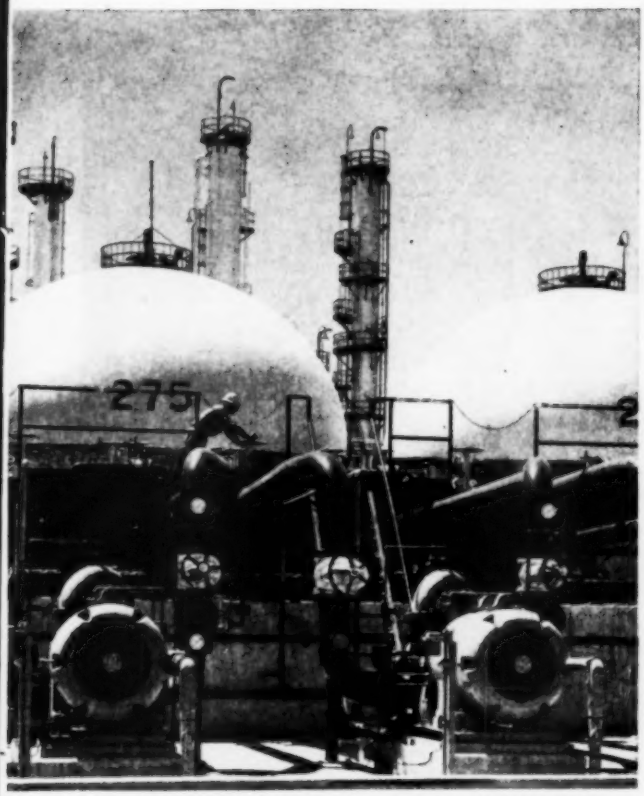
"WORK HORSE" LINEUP of totally-enclosed, fan-cooled Tri-Clad* motors under topping units meet rigid requirements for continuous processing and safety. Cast-iron frame construction helps protect punchings, windings, and rotating parts from dusts, moisture, and corrosive atmospheres. Each motor has a matching explosion-proof push-button station

*Registered Trade-mark of General Electric Company

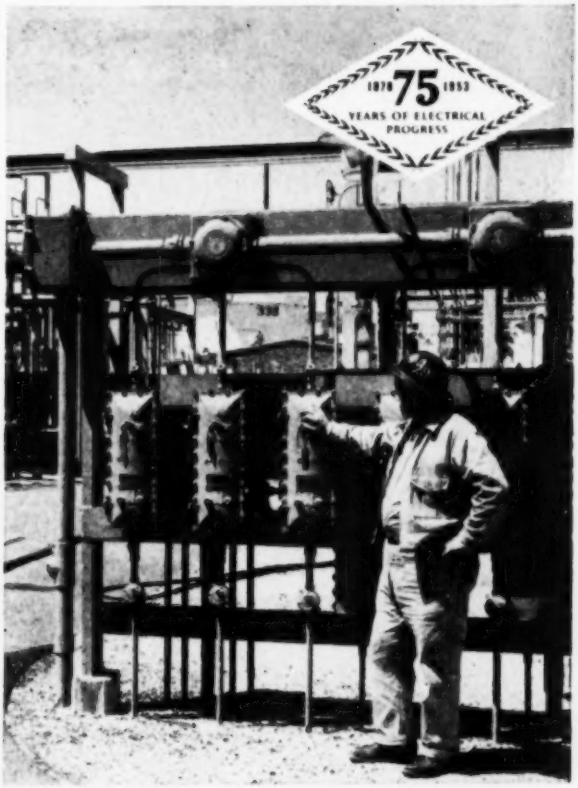
System-planned electric equipment



COMPACT, OUTDOOR METAL-CLAD SWITCHGEAR in foreground is the main distributing point of power to Union Oil's Wilmington refinery. Providing primary circuit protection, these compact G-E units are factory-assembled and shipped ready to install. They're simple to operate and maintain because of a fast, vertical-lift system of breaker removal.



TOTALLY-ENCLOSED, CLASS 1 GROUP O G-E MOTORS are designed for corrosive and hazardous refinery locations—like these two Tri Clad units driving transfer pumps.



EXPLOSION-PROOF motor starters have cast-alloy enclosures, helps protect against hazards. They are centralized on one rack for easy accessibility and a better distribution system.

helps keep throughput high at Union

CENTRALIZED G-E LIMITAMP CONTROL, located in a non-hazardous area, starts and protects motors driving refinery equipment.

Two new topping units at Union Oil's Wilmington refinery kept on-stream by G-E power and drive equipment

Recently, the Union Oil Company wound up a $27,000,000 expansion program at their Wilmington, Calif. refinery by putting two new 20,000 bbl.-per-day topping units and the nation's largest vacuum flasher into action.

To help maintain this output on a continuous basis, Union Oil and General Electric engineers co-ordinated all drive and power distribution equipment—"system-planned" it—to the plant's specific processing needs.

G-E application engineers, experienced in refinery practices, are ready to assist you and your consultants in planning an efficient electrical system.

TO HELP CUT YOUR POWER DISTRIBUTION COSTS be sure to see the new full-color sound slidefilm, "The Vital Link." It's another G-E "More Power to America" program. Ask your G-E apparatus sales representative to arrange a showing. General Electric Company, Schenectady 5, New York. 661-42

Engineered Electrical Systems for Petroleum Refineries

GENERAL ELECTRIC

BalanSeal and FarriSeal Safety-Relief Valves

(Pat'd & Pat. Pending)

Farris

ENGINEERING CORPORATION

536 Commercial Avenue

PALISADES PARK, NEW JERSEY

Corrosion and varying back pressure—the two dangerous enemies of positive safety-relief valve operation—are stopped cold by the ingenious construction of Farris valves. Critical working parts are isolated from the lading fluid so that they can't stick, plug or corrode and the special bellows construction nullifies the effect of back-pressure surge. You get positive protection, under all operating conditions. Manufacturing economies offer realistic pricing—and the design permits the use of much smaller discharge piping, at an important saving. So for safety and economy, specify FarriSeal or BalanSeal safety-relief valves. You're never stuck, because they never stick!

Technical manual, 51B, a treatment on Back Pressure Piping and Surge characteristics and 76-page catalog is yours for the asking.

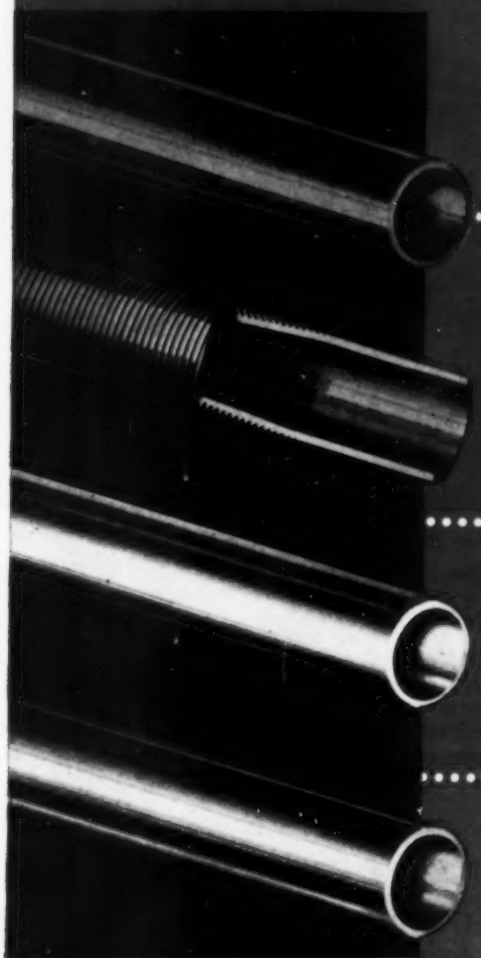
*ASME-N.B. APPROVED
(Certified for Capacity)

Affiliates:

• FARRIS FLEXIBLE VALVE CORPORATION • FARRIS STACON CORPORATION • FARRIS HYDROTORQUE CORPORATION
• FARRIS HYDROSEAL CORPORATION • FARRIS PICKERING GOVERNOR CO.

4 WOLVERINE PRODUCTS for Processors

PRIME EXAMPLES OF TUBEMANSHIP AT WORK!



. . . PRIME SURFACE OR PLAIN CONDENSER TUBE

Wolverine condenser tube of copper and copper-base alloy is produced under the type of control that gives real meaning to the word Tubemanship. Which, in turn, is just another way of saying Wolverine is backed by over thirty-seven years' experience in the manufacture of all kinds of tubing. Wolverine produces plain condenser tube in sizes ranging from ¼" to 2" O.D.

. . . FINNED CONDENSER TUBE—TRUFIN*

Wolverine Trufin—the integral finned tube—provides the following advantages: (1) more compact, economical heat exchanger or condenser unit design, (2) can be assembled, rolled or brazed into headers by conventional methods, (3) in many applications, can greatly increase capacities of existing units, (4) can be directly substituted for prime surface condenser tubes.

Trufin is made in a wide range of sizes for shell and tube units. Trufin is available in copper, copper-base alloys, aluminum, carbon and stainless steel, as well as in bi-metal.

. . . ELECTRIC-WELDED STEEL TUBE

Here again, Wolverine Tubemanship pays off. The same attention to detail, the same quality control standards which have been built up as a result of thirty-seven years of tube-making—combine to produce a dependable new product: Wolverine electric-welded steel tube. Wolverine electric-welded steel tube is produced in sizes ranging from ¼" through 3" O.D.—and in the following analyses: SAE 1010, SAE 1015, SAE 1020, SAE 1025, SAE 1030.

. . . ALUMINUM TUBE

Aluminum tube, too, is another product of Tubemanship. You can get it in 2S and 3S aluminum and in standard sizes from ⅛" through 2" O.D. Wall thicknesses range from .020 through .180. Remember that Wolverine makes Trufin of aluminum or bi-metal—aluminum with a copper lining.

IMPORTANT! Next time any questions arise regarding tubing or its application to your particular problem—just give Wolverine's Technical Sales Department a call. There's no obligation. No cost. In the meantime, write us for an informative, free booklet covering the products which interest you.

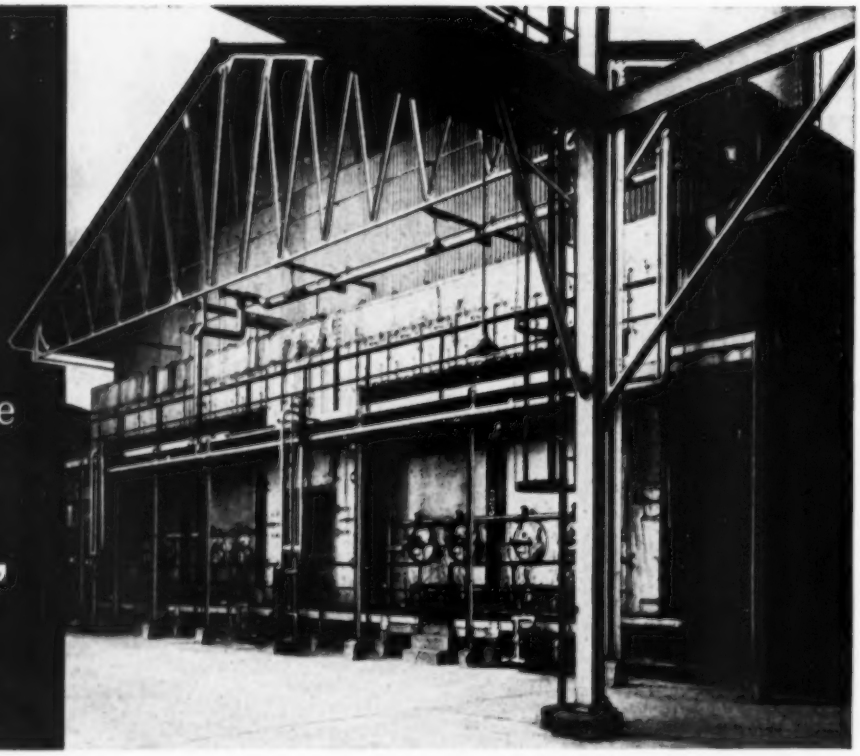
WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.
Manufacturers of Quality-Controlled Tubing
1431 CENTRAL AVENUE • DETROIT 9, MICHIGAN
Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

ESTABLISHED 1916

EXPORT DEPT., 13 E. 40th ST., NEW YORK 16, N. Y.

*REG. U. S. PAT. OFF.
Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

Oil Heater Candidate For A Performance "BLUE RIBBON"



IT'S this Lummus Crude-Vacuum Oil Heater, on the job at the Paulsboro, N. J. refinery, of Socony-Vacuum Oil Company, Inc.

This unit was placed in service in November 1949. Except for a seven-day shutdown early in 1951, solely for plant considerations, *its first run was for 3½ years*. When the heater was opened it was found to be in good condition . . . with remarkably little maintenance necessary considering the unit's time in operation.

With a design duty of 83,000,000 Btu/hr., the heater during the last 3½ years has handled approximately 40% *more* than design rating. Refinery people say the heater could operate at even greater capacity.

Operating results like these at Paulsboro uphold Lummus' reputation as designers and fabricators of oil heater equipment for refineries, chemical, and petrochemical plants. In addition to superior performance, Lummus oil heater installations are marked by ease of operation and flexibility necessary to allow frequent switching of stocks.

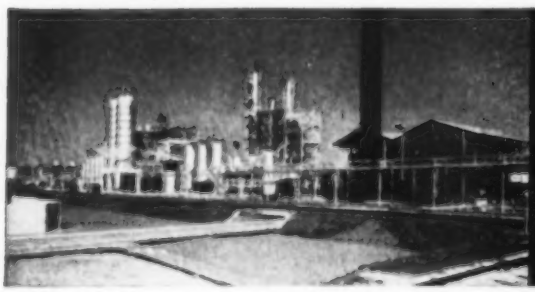
Have we suggested a few important reasons why a Lummus Oil Heater will fit into your processing picture? We'll be pleased to have our specialists talk it over with you.

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

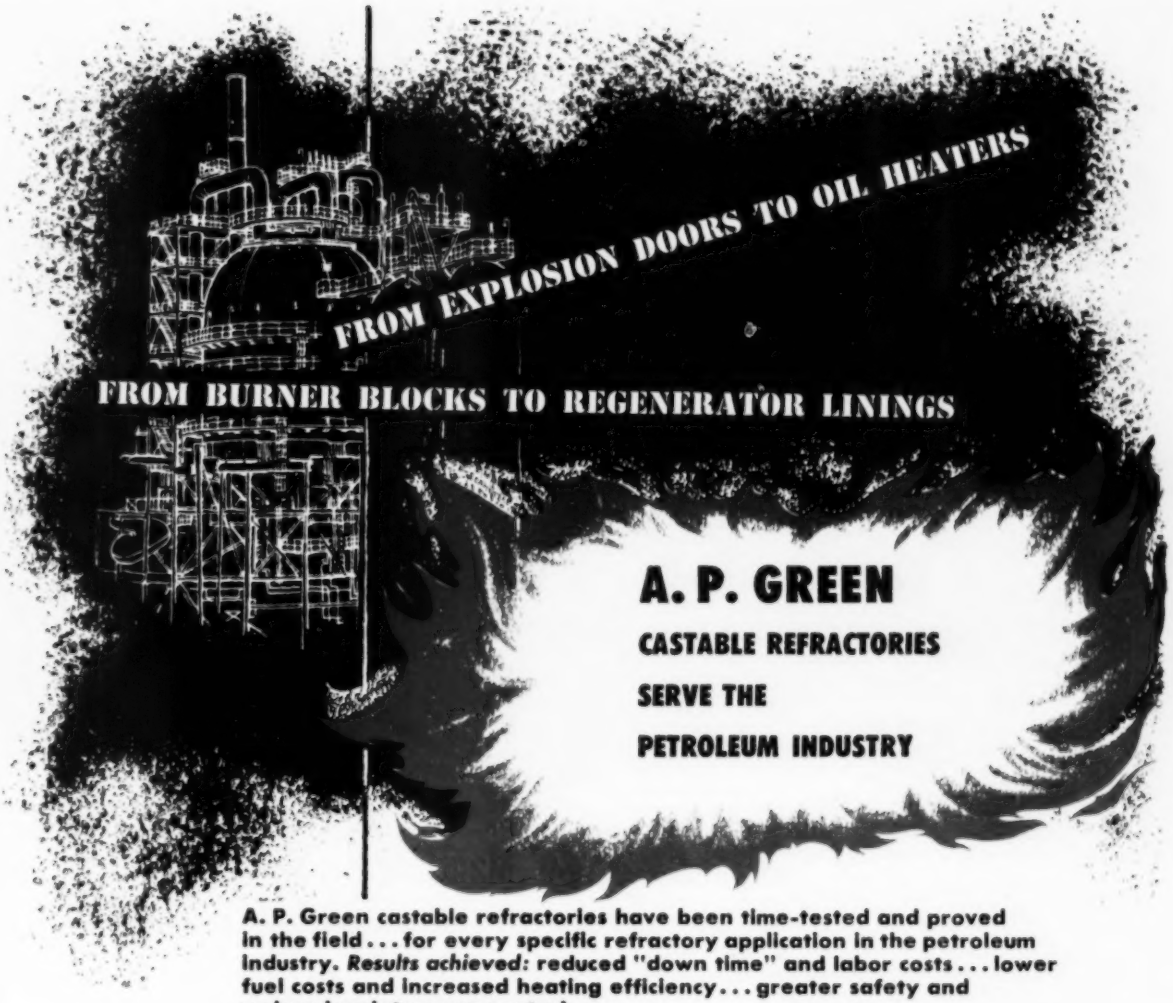
HOUSTON • CHICAGO • LONDON • PARIS • CARACAS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES



Across the Sea . . .

Shown at right in this photograph are Lummus Hot Oil Belt Heaters which satisfy by means of a circulating hot gas oil stream all heat requirements for the lube oil plant of a modern refinery at Dunkirk, France. This installation, as in the case of others similar to it, is characterized by a low initial investment since it eliminates a number of smaller heaters with their attendant engineering and erection costs.



A. P. Green castable refractories have been time-tested and proved in the field . . . for every specific refractory application in the petroleum industry. *Results achieved:* reduced "down time" and labor costs . . . lower fuel costs and increased heating efficiency . . . greater safety and reduced maintenance control.

For detailed information and specific recommendations . . . write, Engineering Department, A. P. Green Fire Brick Company . . . or call your local A. P. Green distributor.

A. P. Green Castable Refractories . . . designed to exact specifications to do an exact job

KAST-SET — A rapid setting, high strength refractory castable. Mixed with water, it takes on a hydraulic bond without the application of heat. KAST-SET will not shrink, has excellent resistance to abrasion, and is ideally suited for monolithic linings. It may be used at temperatures up to 2700° F.

KAST-O-LITE — A lightweight castable recommended for temperatures up to 2500° F. It is used for monolithic linings in all types of stills and heaters, tar stills, heat treating furnaces, flues, and stacks. Reduces heat loss. Insures closer temperature distribution and control.

CASTABLE INSULATION NO. 20 — A hydraulic-setting castable for temperatures up to 2000° F. Recommended for complete monolithic linings and lightweight panel construction in oil stills and heaters. Weighs 50 pounds per cubic foot in place.

CASTABLE BLOCK MIX — A hydraulic-setting castable insulation for temperatures up to 1600° F. CASTABLE BLOCK MIX combines the advantages of a castable material with low conductivity and light weight. It provides maximum insulating efficiency and ease of installation. Weighs only 20 pounds per cubic foot in place.

CASTABLES FOR GUN APPLICATION . . . SK-7 — Gun application of SK-7 produces a lightweight lining with excellent strength and insulating efficiency for temperatures up to 1800° F. Installation and labor costs are reduced . . . no forms required. Ideal lining for ducts, flues and breechings.

KS-4 — This strong abrasion resistant castable can be gun applied with a minimum of rebound loss. Recommended for catalytic regenerator linings, stack linings, bubble towers, and duct linings exposed to abrasion or corrosion. For temperatures up to 2550° F.

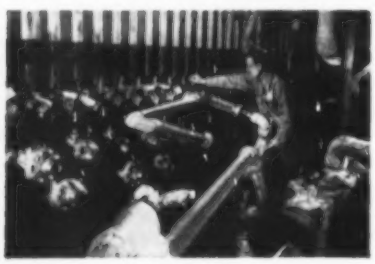
A. P. Green REFRACTORY PRODUCTS

A. P. GREEN FIRE BRICK CO., MEXICO, MISSOURI, U. S. A.

In Canada, **A. P. GREEN FIRE BRICK CO., LTD.,** TORONTO 15, ONTARIO

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

CHIKSAN Swivel Joints illustrated in this installation, facilitate the speedy, economical handling of various fluids through 16 lines from loading dock to manifolding pit — a distance of 800 feet. Since each line leads to a separate tank through the manifold, cross contamination is eliminated.



CHIKSAN Swivel Joints in the pump manifold above enable operator to pull base stock from outside storage into the plant and direct flow to proper vessel or proportioner.

The Flow of Enterprise Relies on

CHIKSAN

Ball-Bearing Swivel Joints

CHIKSAN Manifolding Saves 3 Ways!

- √ ORIGINAL INSTALLATION
- √ NO CONTAMINATION LOSSES
- √ LOW COST OPERATION

Original cost of CHIKSAN flexible line manifolding installations often run as much as 50% less than fixed line manifolding operations which incorporate costly multiple valve and line systems.

A CHIKSAN manifolding operation is simplified in its entirety — providing complete flexibility, mobility and ease of operation in limited spaces.

CHIKSAN manifolding installations reduce line hook-up time — keep pit floor clear of lines thereby providing greater working areas.

CHIKSAN manifolding operations facilitate the transfer of all types of fluids safely and rapidly under extreme climatic conditions with no possibility of cross contamination.

CHIKSAN manifolding installations are specifically engineered for long life — easy and economical maintenance, and render years of trouble-free operation.

Our Engineering Research and Development Department will welcome inquiries on your manifolding problems.

Write for Catalog 53-C, Dept. PR-10

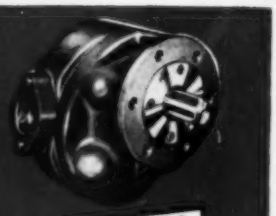
CHIKSAN

Representatives in Principal Cities

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 28, Illinois • Newark 2, New Jersey

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Chiksan Export Company (Subsidiary), Brea, California • Newark 2, N. J.

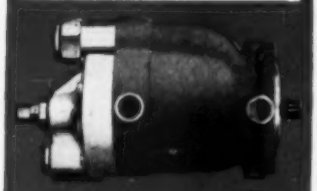
PUMPS
for
PETROLEUM



HYDRECO

GEAR TYPE PUMPS

Reversible and non-reversible. Gear type pumps in exclusive FOUR-BOLT design . . . capacities from .5 to 130 gpm and operating pressures to 1500 psi . . . flange or foot mounted . . . furnished with keyed shaft with spline shafts optional. Also dual and tandem models.



STRATOPOWER

PISTON TYPE PUMPS

Axial reciprocating piston type . . . constant or variable delivery with capacities of .25 to 10 gpm at nominal speeds of 1500 rpm with maximum of 4500 rpm . . . working pressures to 3000 psi . . . direct engine and individual electric motor driven models.

FLUID POWER PUMPS

in equipment and vehicles required for modern exploration, drilling, production, piping and refining of petroleum. Here is a most comprehensive range of sizes, types, capacities and pressures from 0 to 1500, 2000 and 3000 psi together with hydraulic motors, valves and cylinders for developing complete hydraulic circuits. Here is power which combines safety, flexibility, limitless variations and sound economy . . . hydraulic power at its best.

LIQUID HANDLING PUMPS

Virtually "any substance that will flow through a pipe," including petroleum products from naphthas to crudes and acid sludge, can be efficiently and economically handled in small or bulk quantities by Pumps available from this single source. There are deep and shallow well "Centrifugal and Turbine Types, Rotating Plunger and Herringbone Pumps embracing a very broad range of types, sizes and constructions.

VACUUM PUMPS

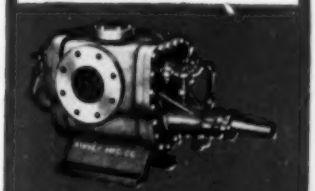
High vacuum pumps for laboratory or high production service in research, vacuum distillation, refrigeration, dehydration, chemical processing, de-aerating, etc.

Write for full information ➡

DUDCO

DUAL VANE TYPE PUMPS

DUDCO Pumps provide a broad range of sizes with capacities to 120 gpm and pressures to 2000 psi. Also available in dual units operating from a single drive. Hydraulic motors with starting torque outputs to 14,000 lb. in.



KINNEY

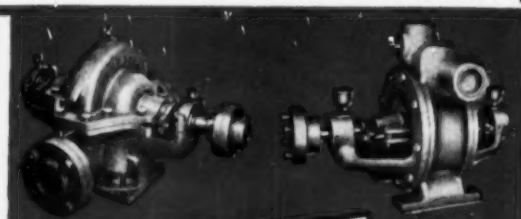
LIQUID HANDLING PUMPS

A complete range of sizes in Rotating Plunger and Herringbone Gear Pumps to handle light or heavy liquids from gasoline to asphalts. Available in plain or steam jacketed models.

KINNEY

VACUUM PUMPS

Single stage models to produce absolute pressure readings of 10 microns (.01 mm Hg.) . . . compound pumps producing readings of .2 microns (.0002 mm Hg.) or better. These Kinney High Vacuum Pumps are available in sizes for laboratory as well as high production use.



AURORA

CENTRIFUGAL & TURBINE PUMPS

Deep well, sump, drainage and condensation return units, household water systems. Industrial low and high pressure liquid handling pumps. Direct motor and countershaft driven horizontal and vertical models. Capacities 3 to 7500 gpm.

THE NEW YORK AIR BRAKE COMPANY
230 Park Ave., Dept. PR, New York 17, N. Y.

Gentlemen: Kindly send additional information on the pumps I have checked.

☐ Hydreco Pumps ☐ Kinney Liquid Handling Pumps
☐ Stratopower Pumps ☐ Kinney Vacuum Pumps
☐ Dudco Pumps ☐ Aurora Pumps

Name_____

Address_____

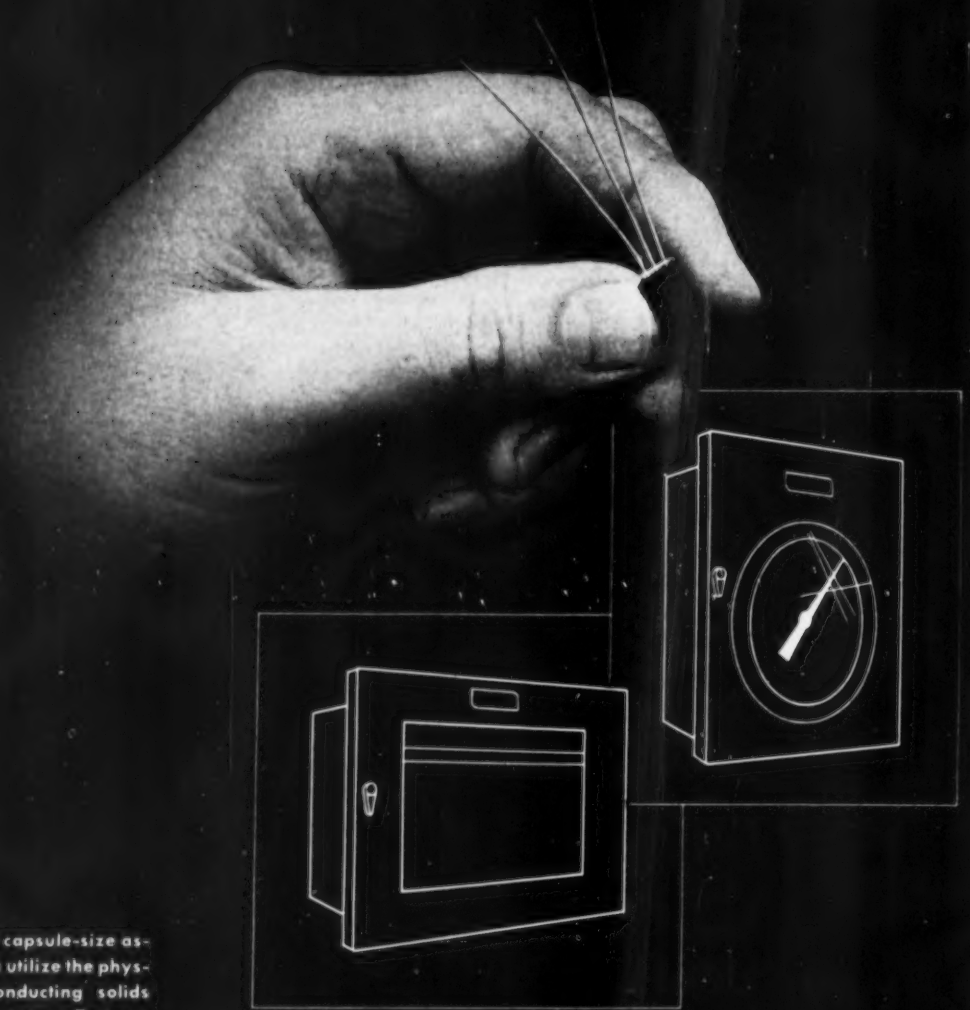
City_____ State_____

THE NEW YORK AIR BRAKE COMPANY

230 PARK AVENUE • NEW YORK 17, N. Y.

Transistors*

in instrumentation...



*Transistors are capsule-size assemblies which utilize the physics of semi-conducting solids to produce the same effects as an electronic tube . . . but without cathode and/or filament and their circuitry components.

When ?

A timely statement from Walter P. Wills,
Director of Research, Brown Instruments Division
Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa.

"PERHAPS you've wondered when transistors, with their widely publicized characteristics, will be put to work in industrial instrumentation. Naturally, I can speak only for my company, but I'd like to give you a research man's view on where transistors stand today.

"We agree that transistors have a tremendous future in all of electronics, including automatic control. Many problems, however, must yet be solved. Will they be made of germanium or silicon? Can they be made more reproducible and able to handle enough power at desired voltages? New circuits and new transistor types are needed. Today's costs are much too high. And let's not forget that the vacuum tube is still being developed after more than 40 years of existence.

"Even with extensive research and development programs, much more work remains before transistors can be broadly utilized in their natural markets—radio, television, and other communication equipment. Similarly, the few types now available do not nearly satisfy the requirements of industrial instrumentation.

"A 'tubeless' electronic instrument is theoretically possible today, and, on the basis of safety and reliability expected of modern instruments, it is anticipated that such a product is completely possible and practical in the future.

"So we're attacking the problem on a broad front. For upwards of five years, we've been devoting a large portion of our research facilities to studying ways to utilize transistors . . . looking on them not solely as replacements for tubes, but as the starting point for totally new instrument circuits.

"In addition, we have invested in the patent licenses and the know-how of Bell Telephone Laboratories, the pioneer of transistors. We have a large stake in providing instrumentation for the manufacture of transistors and hence are examining all facets of the transistor business . . . even to the extent of making some with our own hands.

"Honeywell instruments and other Honeywell controls using transistors will be on the market. When they are, you can be sure they will be great products—new, but the same kind of reliable, versatile, well-engineered products we sell today."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

for

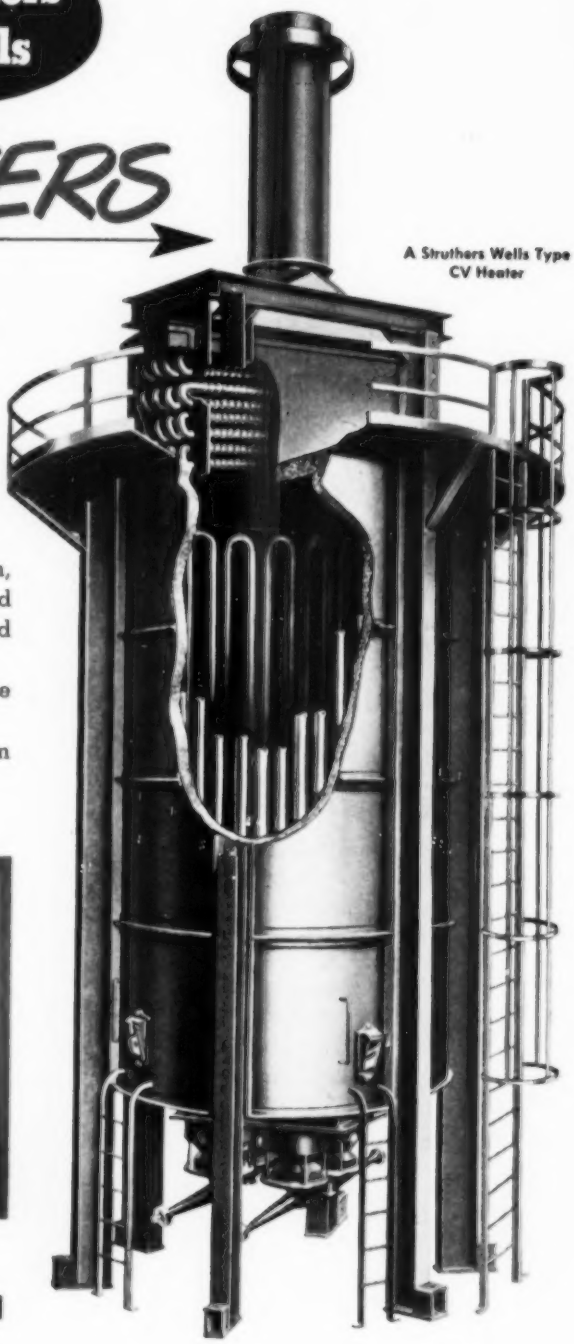
RICH OIL HEATING

GAS AND STEAM HEATING

CATALYTIC REFORMING

MANY OTHER HEATING REQUIREMENTS

Specify Struthers Wells VERTICAL FIRED HEATERS



A Struthers Wells Type CV Heater

Struthers Wells Vertical Heaters are widely used throughout the petroleum industry.

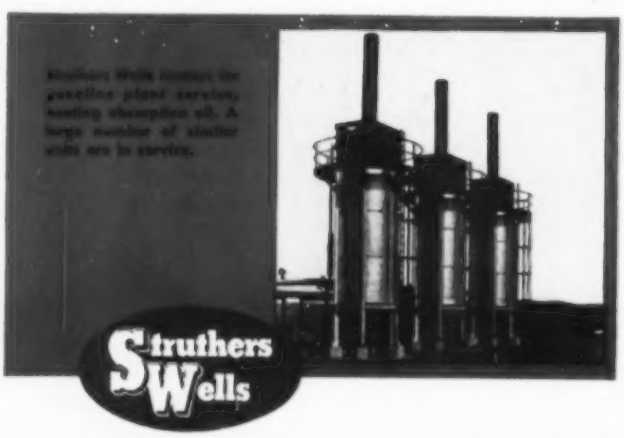
High thermal efficiencies may be secured with these Heaters—an important factor where the cost of natural gas and other fuels is increasing so rapidly.

Standard units are available in a wide range of sizes, with most equipment available for prompt shipment using stock materials.

Circulating systems are available, using oil or Dowtherm, for the indirect heating of grease kettles, reactors, and other equipment. This equipment is generally supplied complete with all accessories.

Electrically heated units for circulating heating are available for pilot plant or small scale operation.

New Bulletin C-45 is available; please send request on your letterhead.



Struthers Wells

STRUTHERS WELLS CORPORATION

WARREN, PA.

Plants at Warren and Titusville, Pa. *Offices in Principal Cities*

In the Petroleum Industry W-S Screw-End Fittings . . .

MORE ECONOMICAL ALL THE WAY DOWN THE LINE

FOR REAL ECONOMY on your next screwed fitting piping job specify Watson-Stillman the Double-diamond brand of Forged Steel Fittings.

You'll find their long, accurately cut threads, in perfect alignment, assure ease of installation.

You'll find their extra long bands extending well beyond the last thread, provide reinforcement at points of severest strain.

You'll find their heavy uniform fitting wall thickness provides a high safety factor to give you years of leak proof, trouble-free service.

Accurately machined . . . they fit tight and they're made of forging stock especially selected for toughness, strength, and resistance to temperature and shock. Available in carbon, stainless and chrome-moly alloy steels.

Watson-Stillman also makes a complete line of forged Socket-Welding fittings. Investigate these superior, life-of-the-system joints. Write for literature.

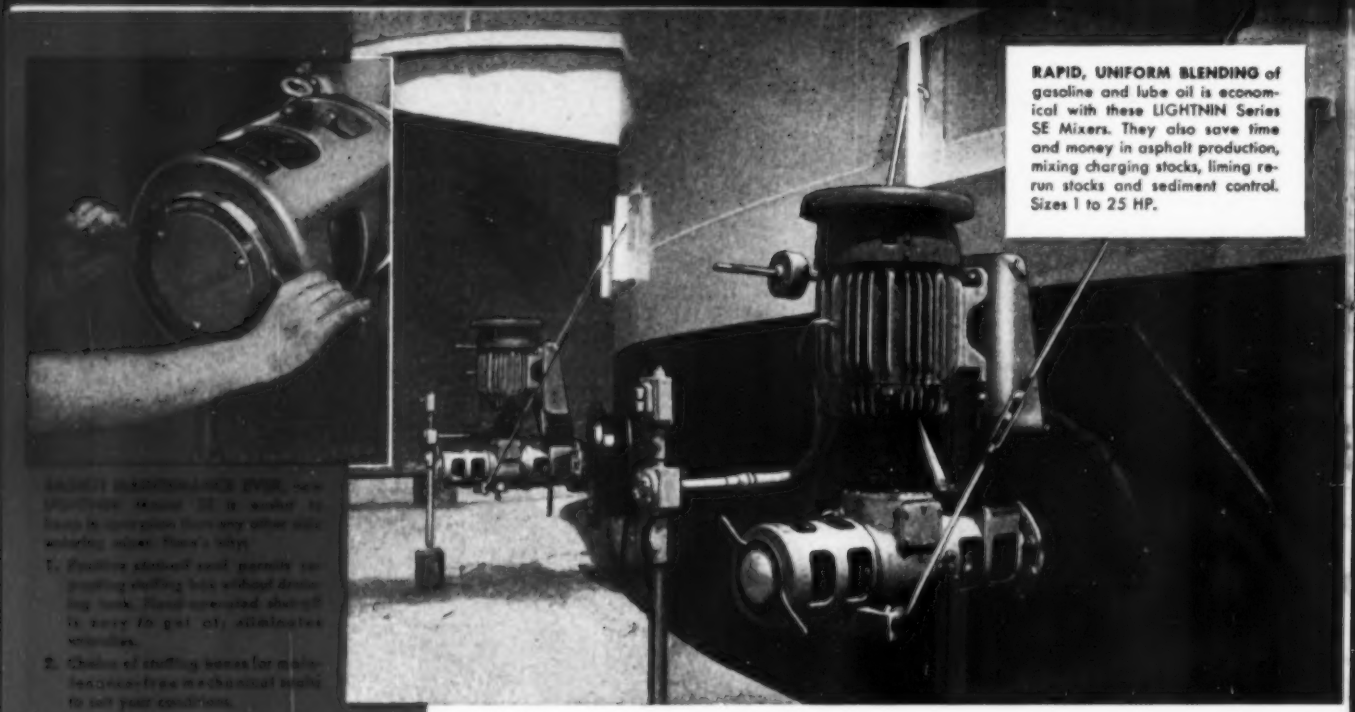
SOLD THROUGH LEADING DISTRIBUTORS

WATSON-STILLMAN FITTINGS DIVISION

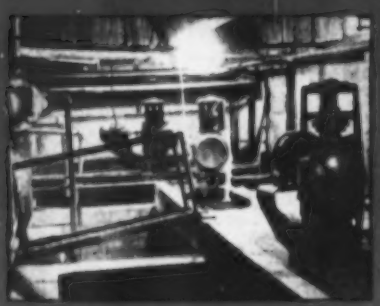
H. K. PORTER COMPANY, INC.

128 ALDENE RD., ROSELLE, NEW JERSEY

9-0-6



RAPID, UNIFORM BLENDING of gasoline and lube oil is economical with these LIGHTNIN Series SE Mixers. They also save time and money in asphalt production, mixing charging stocks, liming re-run stocks and sediment control. Sizes 1 to 25 HP.



YOU'LL FIND IT FAST and easy to suspend blending clay, do continuous treating and reacting, mix drilling muds, with LIGHTNIN Series TE Mixers. Sizes 1 to 500 HP.

FOR SMALLER MIXING applications such as acid and solvent contacting, caustic and doctor treating, feed water treating, suspending filter aid and preparing specialties, it pays to specify LIGHTNIN Portable Mixers. Sizes ⅛ to 3 HP.

Get these helpful LIGHTNIN Catalogs

This library of mixing information is yours for the asking. Catalogs contain helpful data on impeller selection; sizing; best type of vessel; valuable installation and operating hints; complete description of LIGHTNIN Mixers.

MIXCO fluid mixing specialists

Blend 10,000 gal. of lube oil in 20 min.

. . . save up to 50% on HP input

Now you can blend 10,000 gallons of lube oil in only 20 minutes with just one 7½ HP LIGHTNIN Series SE Mixer.

The exceptionally high volumetric flow of these units not only cuts blending time, but assures uniform viscosities with no "dead spots" in the tank.

Yet, this is only one of the applications which can be performed better and faster with these mixers. For example, you can slash hours off gasoline blending and ethylizing time; cut back asphalt in ⅛ the time required by recirculation; uniformly mix charging stocks.

Tank farm operators are also saving thousands of dollars in cleaning costs and storage space, by using these units to control bottom sediment.

GUARANTEED RESULTS

Best of all, you eliminate guesswork when you use LIGHTNIN Mixers. Thorough, progressive research enables MIXCO to accurately predict your processing results—and guarantee those results or your money back.

Send for Catalog B-104 and get the facts on the savings possible with LIGHTNIN Side Entering Mixers. Mail the coupon today.

Lightnin® Mixers

MIXING EQUIPMENT Co., Inc.

164 Mt. Read Blvd., Rochester 11, N. Y.

In Canada: William & J. G. Greey, Ltd., Toronto 1, Ont.

- ☐ DH-50 Laboratory Mixers
- ☐ B-75 Portable Mixers (electric and air driven)
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller type)
- ☐ B-104 Side Entering Mixers
- ☐ B-106 Condensed Catalog (complete line)
- ☐ B-107 Mixing Data Sheet

Please send me the catalogs checked at left.

Name_____ Title_____

Company_____

Address_____

City_____ State_____

The **Look Box** for October

Spotlight on Symposium

AN ESPECIALLY attractive feature has been developed for this issue to tempt the reading taste of PETROLEUM REFINER subscribers. The 16 power-packed pages labeled "Symposium on Economics and Cost Estimating," beginning on page 97, bears promise of being one of the most valuable contributions published by the REFINER (or any other technical magazine!) in recent years.

Readers constantly badger editors for more information on economics and cost estimating. The supply of such articles has been exceedingly meager. The reason has been simple—most companies are reluctant to reveal their innermost secrets on economics.

Presented herein for the first time is a notable exception. Four progressive companies swept aside the usual secrecy restrictions and allowed some of their topflight engineers to present concise, factual information and data on their systems for computing economics and estimating costs.

The publisher and editorial staff of PETROLEUM REFINER and the many thousands of REFINER readers throughout the world would like to thank the executives of four companies for their intelligent cooperation and enlightened progressiveness in resolving a heretofore conspicuous void in the literature. These companies are: Blaw-Knox Company, Humble Oil & Refining Company, The Ethyl Corporation, and Harold Bottomley, petroleum consultant.

Dispersion is Old Stuff

THE PETROLEUM refining industry has anticipated by a number of years a pattern of dispersion which the Defense Department has noted in a recent study of building trends.

The government's interest in the matter is that an isolated plant would offer an enemy bomb only one target, whereas a concentration of plants or a plant located in a city would present a multitude of targets.

The problems of modern industrialization encouraged dispersion for some years before there was fear of bombs. The plant that locates well away from population centers at once enjoys the benefits of lower real estate costs and lower taxes, among other factors, without paying the penalties which isolation entailed a score of years ago. Chief among these was the problem of personnel transportation, now solved by good roads, wide ownership of automobiles, and the practice of using company busses to transport employes.

Gasoline Status Brighter

RECENT WEEKS have produced a much brighter outlook on the gasoline stocks picture, as refiners began cutting their operating rates and thereby lessening the chance of excessive supplies being piled up by next spring. For the first time since the third week in May, daily crude runs to U. S. refinery stills have been held to less than 7 million barrels.

During the week of September 26, crude runs averaged 6,880,000 barrels a day, and a week earlier they had amounted to 6,992,000 daily. That was the first break from the 7-million-a-day rate that started during the week of May 30, and which saw daily operations rise to an all-time high of 7,267,000 barrels in mid-July.

Although the latest report showed some decline in gasoline stocks, they are still too high for this time of the year and continued lowered refinery runs should be the order. Inventories now total about 141½ million barrels.

It is customary for the industry to add about 45 million barrels of motor fuel during the winter season. If refiners can hold stock build-ups to 25 million by April 1, the motor fuel market should be able to continue with steadiness until it firms with the advent of spring's heavier demands.

No jeopardy would be placed on the heating oil markets by continued curtailment of refinery operations. Both distillate and residual fuel stocks are in pretty good position and distillate still has several months to build before heavy winter needs are at hand.

How does tetraethyl lead reduce *Pre-Ignition*?

• Research at the DU PONT PETROLEUM LABORATORY designed to help refiners solve pre-ignition problems through the use of additives

At present, pre-ignition during road operation threatens to limit further improvement in the efficiency of fuel utilization in passenger-car engines.

However, on the basis of extensive pre-ignition research, the Du Pont Petroleum Laboratory believes this problem may be solved in one or more ways.

The solution to the problem has been sought by:

1. Reducing the tendencies of combustion chamber deposits to glow and cause surface ignition of the charge.
2. Improving the ability of fuels to withstand ignition by such hot surfaces.

CERTAIN ADDITIVES reduce deposit glow and offer a solution to the problem. However, as engine compression ratios are increased still further it may also be necessary to increase the pre-ignition resistance of the fuels themselves.

EFFECTIVENESS OF TETRAETHYL LEAD AS AN ANTI-PRE-IGNITION AGENT

Some hydrocarbons are more sensitive than others to ignition by glowing deposit particles. Preflame reactions tend to sensitize the fuels to ignition. The effect of these preflame reactions can usually be minimized by tetraethyl lead, thus increasing the pre-ignition resistance of the gasoline.

CONTINUING STUDIES

This research on pre-ignition is part of a continuing program by the Du Pont Petroleum Laboratory. More complete details on these investigations can be obtained from any Du Pont Petroleum Chemicals Division district office listed below. Ask for papers entitled "Pre-Ignition in Automotive Engines" and "An Investigation of Pre-Ignition in Engines."

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices:

NEW YORK, N. Y.—1270 Ave. of the Americas	Phone COlumbus 5-3620
CHICAGO, ILL.—8 So. Michigan Blvd.	Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue	Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg.	Phone PRestan 2857
LOS ANGELES, CALIF.—612 So. Flower St.	Phone MAdison 1691

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

Have You Noticed It?

ON PAGE 1 of PETROLEUM REFINER is a set of initials white on a black background, "ABC". Like a lot of things which one gets accustomed to seeing, they are seen but probably not understood, by the more than 12,000 subscribers to PETROLEUM REFINER.

What does "ABC" on our mast-head mean? It means that PETROLEUM REFINER is a member of an organization known as the Audit Bureau of Circulations and that it has voluntarily agreed to and pays for an audit of its circulation records each year which is as tough or tougher than most bank audits!

Every industry has its peculiar set of economics and those of the publishing industry are peculiarly peculiar! The cost of gathering the information, printing and mailing it in publication form, in a publication like PETROLEUM REFINER, runs into a lot of dollars per year.

In the early days of periodicals, the subscriber paid the entire cost, plus a profit to the publisher. Then as time went on, individuals or companies with something to sell realized that they could announce those products for sale in the publications and thereby sell more.

And so advertising entered the scene. After a while the publishers discovered that the more people they had reading their publications, the more advertising they could carry, the greater the price they could get for their advertising, and finally it grew to the point where advertisers paid most of the costs and subscription prices took a terrific tumble.

This was true 40 or 50 years ago just as it is true today. The subscriber pays only a small part of the cost of producing the publication. The advertiser who wants to "talk to the subscribers" through the publication's advertising columns pays the balance. Since not only advertising volume but advertising rates were based on subscriptions and since advertisers felt that paid subscriptions were better than "give away copies," every publisher came to feel that he had a stake in a large paid circulation and every advertiser felt that he had a stake in making sure the circulation was "as claimed."

So a racket arose! One of the things which could be checked was press runs and paper purchases, so some publications, notably newspapers in certain points, printed the number of copies they claimed and then couldn't get rid of them. There is the story of boatloads of papers being taken out and dumped into a certain large lake. There are stories of barns being filled with undelivered newspapers.

Because there were dishonest as well as honest publishers, just as there have been known to be dishonest as well as honest bankers, the publishing business was pretty much in the same shape that the banking business was in before the government put around it the safe-guards of bank examinations.

So around four decades ago, out of this chaos the Audit Bureau of Circulations arose. It was sponsored jointly by honest publishers, and concerns that spent a lot of money for advertising. Most of the financial burden of the examinations was put on the publishers, although the advertisers made a contribution. The board of directors was, as it should have been, dominated by advertisers but publishers had representation on it.

Before long, a publication had to belong to the Audit Bureau of Circulation if its claim to paid circulation was to be regarded by the advertiser.

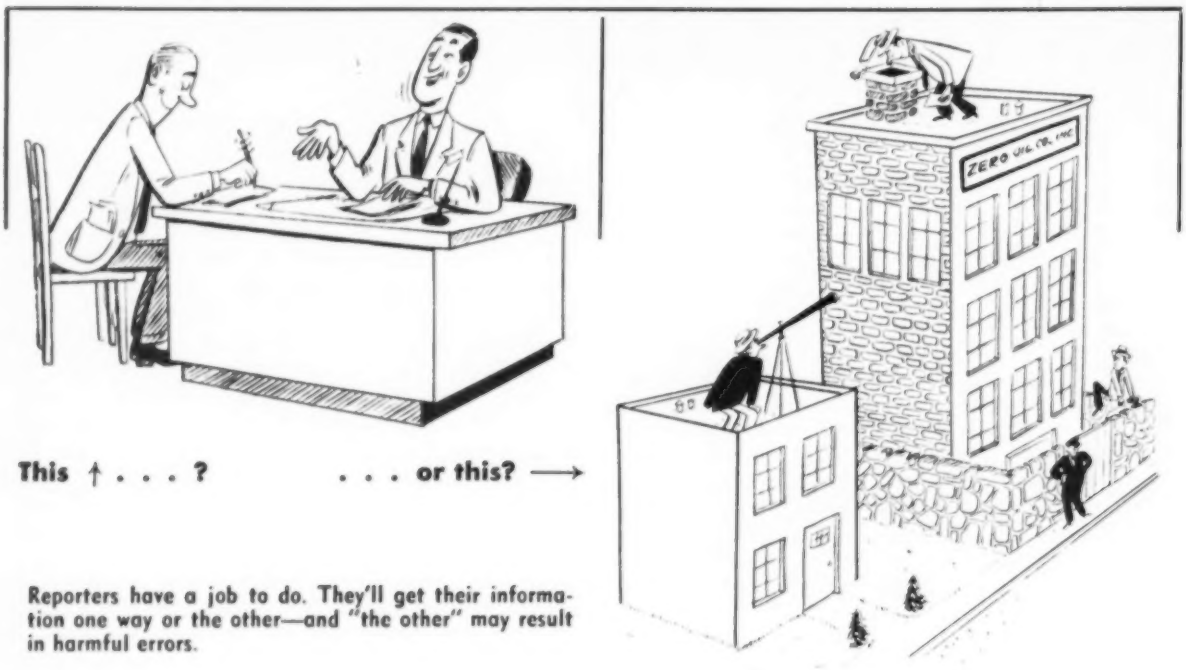
The examination by a highly competent ABC auditor is a thorough thing. Even the envelopes carrying the subscriptions to PETROLEUM REFINER must be preserved along with the subscription order. Funds must check out exactly. Pressruns and paper purchases must check out. The bookkeeping procedure in the circulation department must be in accordance with ABC approval. If ABC thinks that a publisher is "faking" some circulation, it can send out, at the expense of the publisher, as many letters as it desires to subscribers asking about the origin of the subscriptions and if the replies show that chicanery has been engaged in, drastic cuts in the circulation statement can be made.

Subscriptions under Audit Bureau of Circulations Rules are divided into various classifications, those sent in by the subscriber himself, those taken out by a company for its employes is another, those sent in by subscription agencies form still another, subscriptions taken out and paid for by a company unrelated to the subscriber forms still another, and woe to the publisher that tries to get "slick." Even the positions held by subscribers to business publications must be shown on the subscription records which are audited by ABC.

What happens when ABC finds that a publisher has been deliberately falsifying his statements? In all of our recollection of the ABC and business publications there is only one instance that we recall of such an abuse by a publisher, though there may have been others. In that particular instance, we heard that the violation was flagrant. It happened a long time ago in the early days of ABC and served as a splendid example. The publisher was given a choice of disposing of his publication immediately or of facing a charge of perjury. At least, that was what the grapevine said. The publication changed hands and shortly went out of business.

PETROLEUM REFINER is proud to be a member of the Audit Bureau of Circulations and to carry the symbol of membership on its masthead page.

Ray L. Dudley



This ↑ . . . ? **. . . or this? ⟶**

Reporters have a job to do. They'll get their information one way or the other—and "the other" may result in harmful errors.

How Are Your Press Relations?

Is there a gulf between you and the newspaper editors? Here is some expert opinion on how you can bridge it.

Al Reese
Petroleum Refiner Staff

"APPARENTLY THERE is still a gulf to be bridged between the men who write and edit the oil pages of newspapers and the men or groups who handle public relations for companies and the industry."

This statement appeared—and has been repeatedly paraphrased—in the *APW Bulletin*, published by the Association of Petroleum Writers, an organization of leading United States oil editors dedicated to improved news reporting.

The oft-noted gulf is as old as the first tight hole ever drilled, older than the first scout who wormed through the underbrush toward a rival's rig, and older than the refining industry's first laboratory secrets. In an industry in which secrecy was once held to be synonymous with survival, a lingering habit of reticence is but natural.

The gulf has been widened by instances of damagingly inept reporting.

Neither side claims to be blameless. One long-time public relations director whose position is such that he addresses vice presidents by their nicknames, told Petroleum REFINER:

"I do not know of any . . . executive who would consciously or intentionally withhold information from me that I should have, but most of the ones I know and work with are prone to forget sometimes, even on important stories. In most cases it's a matter of training, a matter of outlook, a result of innate conservatism, the big old human trait of playing safe when you're not sure. Some of it, however, is the result of failing to realize that you cannot expect favorable recognition in the press unless you are willing to cooperate with the press in furnishing legitimate news that may not be so favorable.

"Perhaps it should be added that there are a great many engineers and lawyers in the oil business, and in important positions. The watchword for these men in their daily work is accuracy and detail. Some of them are afraid of the press because to them segments of the press are neither accurate nor detailed. In working with some of these men, you and I must first become catalysts, then interpreters."

On the other side, an oil writer admitted in the *APW Bulletin:*

"For the most part the oil press . . . is pretty well versed on its subject and is able to present an intelligent and accurate account of what's going on in the oil industry. Opposed to that, however, is a total lack of understanding and accuracy in so many oil stories handled by newspaper staffers with no knowledge of the oil industry. I say that advisedly, being a former city editor on a daily."

Reporting Improved—Recognition of the basic reasons for the lingering gulf between the press and the oil companies is a prerequisite to their dissolution. The standards of oil reporting are being raised through the efforts of the APW and through the acceptance by newspaper managing editors that the oil editor's desk cannot be capably filled by a superannuated reporter of city hall news.

However, this acceptance has often come tardily, with the result that more talented reporters sometimes have difficulty in filling acceptably the greater space being devoted to petroleum activities.

Geared to the press' former indifference, some public relations departments have not quite caught up with the brisk postwar demand for information. This, in the main, consists of educating management to the heightened interest in company affairs and personalities. To this extent there is actually less of a chasm between oil editors and public relations men than between the latter and management. "Why," is the often heard puzzlement from on high, "do those fellows want to write about ME?"

But, on the whole, the industry has accepted to some degree that good press relations are essential to a sound program of public relations. This acceptance is taking place by two methods — evolution and revolution. Evolution results largely from the persistence of public relations men; revolution results from the mandate of enlightened management.

Most spectacular of the revolutionary contributions have been made principally by comparatively new firms—notably the gas transmission companies. Veteran public relations men who have spent years in gently rending the veil from their managements' activities are standing in slack-jawed astonishment as their cohorts open shop with neatly packaged programs, embossed in gold by a management unschooled in tacturnity.

Many another revolution has taken place in older companies under the guidance of men who think like Reese H. Taylor, president of Union Oil Company of California. Here, in Taylor's words, is the press relations creed that Union lives by:

". . . aside from trade secrets, what a company feels it can or cannot explain to its employes, its customers, its stockholders and the public in general is a pretty good indication of how well it is being run. It takes more than money and material to make good products. Without an interested and informed public—customers, shareholders, dealers and employes alike—there would be no Union Oil Company of California."

When the top man of every oil firm echoes these words with sufficient force to make them a real, working policy, the gulf between management and the PR men will seal, leaving only the narrowing gap between the latter and the oil editors. This consists mainly of the mechanics of news distribution. It can be, and is being, bridged by an understanding among the public relations men of what the press wants, and an acceptance by the oil editors of how much the PR men can reveal and how much they can humanly be expected to do.

A frequent complaint among oil editors is that the PR men don't send out enough news of significant developments and seldom turn out bright features.

New Concept—This criticism ignores the changing concept of press relations. As the companies grow in personnel and physical facilities, thereby becoming richer sources of information for a press becoming ever more receptive to news of petroleum activities; and as management places fewer taboos upon information which may be publicized, the burden of the PR man grows heavier.

See YOUR PRESS RELATIONS Page 246

Do's and Dont's of Press Relations

Here are some tips on good press relations from some of the top public relations men in the industry.

DO—

Know your newspapermen. Regardless of the community's size, it should be natural and easy for you to develop and maintain contacts with newspapermen.

Know your authority. Your authority in press relations goes just as far as the scope of your responsibility and authority in your own operation.

Watch your timing. A release for an afternoon paper should be in the hands of the city editor by 9 a.m. To make all editions of a morning paper, a story should be at the newspaper the afternoon before, not later than 6 p.m.

Respect the reporter's time. Give him the information he wants as quickly as possible.

Make available names and phone numbers of press relations people who can be called after office hours.

Send personal letters with release from time to time.

Address the editor by name, and be sure it is the correct one.

Everything you can to improve public understanding of the legitimate role or function of business in a democracy.

DON'T—

Give out information unless you are certain it's correct.

Make statements concerning company policy unless you know the statement is authorized and that it agrees with policy.

Give out information that may tip off competition or injure customers or employes.

Play favorites with newspapers.

Try to get a story in the newspaper just because your company happens to be a good advertiser.

Ask to see a story before it's printed.

Scold, threaten, use trickery or pressure on newspapers.

Thank an editor for running a story. He likes to think he printed it because it was news. Complimenting a reporter is fine, however.

Flood the newspapers and magazines with trivial stories.

Over-do a story in your enthusiasm to get it printed.

Violate a reporter's confidence. If he comes up with an exclusive story and asks for confirmation on it, respect his initiative and do not make a general release of it.

Be evasive. If a question can't be answered for policy reasons or the facts are not ready at the time, don't fail to tell the inquirer so.

Think of all publications, nor of all writers and reporters, as a single group. There are variations which are just as broad as are found in the ministry, finance, science or business.

Fail to remember that business is a democratic institution, which exists in the American economy through the sufferance of the people. It cannot live in an atmosphere of misunderstanding.

You can measure Brown & Root's EXPERIENCE in terms of DOLLARS

Almost four decades of diversified experience in heavy engineering and construction has built a background for Brown & Root that can mean dollars and time saved for your company. This fact is verified by the great number of repeat contracts awarded Brown & Root by a growing list of satisfied clients.

Brown & Root never accepts conventional procedures as final, and constantly probes for better methods in engineering and construction. Centralized responsibility coordinates this thinking and loyal personnel sees it through to fast economical completion.

If your company plans new construction or plant expansion . . . a call from you will place Brown & Root plant planning experts at your disposal . . . no obligation, of course.

BROWN-BILT

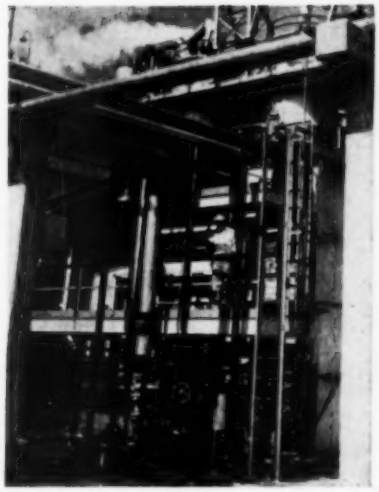
BROWN & ROOT, INC. *Engineers · Constructors*

P. O. BOX 3, HOUSTON 1, TEXAS

CABLE ADDRESS — BROWNBILT

Associate Companies:— BROWN ENGINEERING CORP. • BROWN & ROOT MARINE OPERATORS INC.

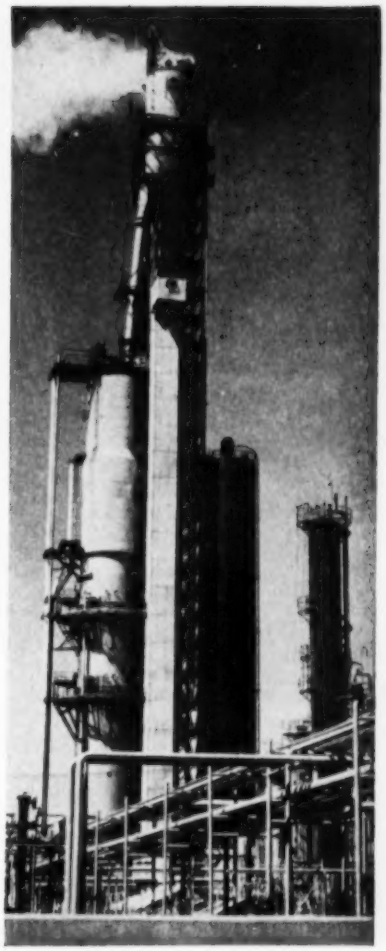
1. Expansion at Texas City Refining's Texas City refinery included this vacuum flash tower and . . .



2. This new viscosity breaker which was built to increase the oil stock supply to accommodate . . .

Huge Cat Cracker Dedicated

New Houdriflow catalytic cracking unit at Texas City Refining's plant is the largest in the world with a capacity of 19,000 barrels a day.



3. This huge new Houdriflow catalytic cracking unit built by Kaiser which is said to be the largest of its type in the world.

THE WORLD'S LARGEST Houdriflow catalytic cracking unit was officially dedicated at Texas City, Texas, September 25 by Texas City Refining, Inc. W. H. Fetter, Texas City Refining's vice president and general manager, said the new unit is undergoing its final shakedown and is expected to reach full capacity production soon. It will have a 19,000-barrel-per-day capacity.

More Versatility. The new Houdriflow unit will give the plant a wider range of products and more versatility in its operation than previously. Its principal output will be components of high octane gasoline and domestic furnace oil derived from low value residuum.

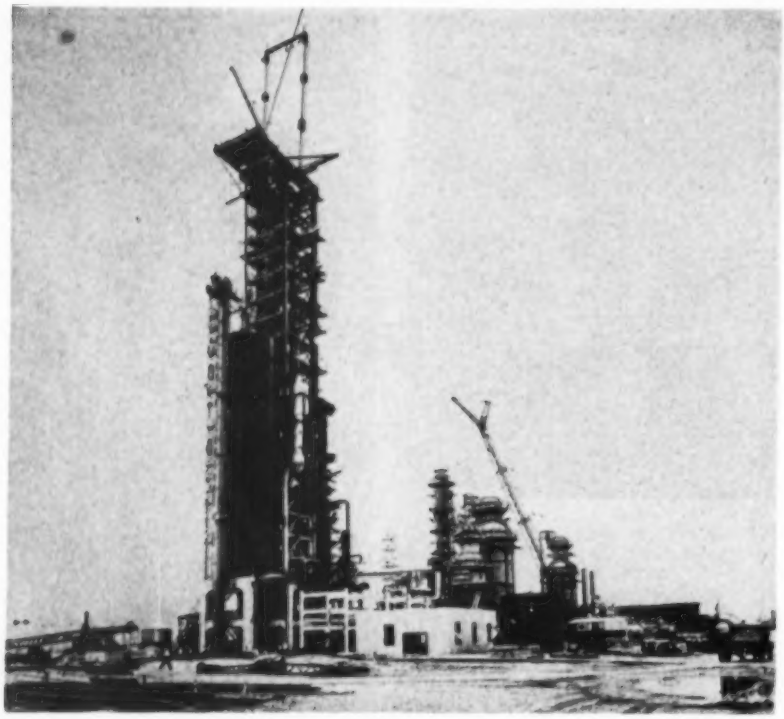
The basic process design of the new cracking plant was done by the Houdry Process Corporation of Philadelphia and the balance of the engineering was carried out by Kaiser Engineers of Oakland, Calif., which also constructed the big cat cracker.

Other Completions. A viscosity breaker and a vacuum flash tower were also part of the Texas City expansion program, as well as the modification of other equipment made necessary by the huge new Houdriflow unit. These were completetd many months ago and put into service immediately, tying in with the older units of the refinery.

Prepared for Big Blows. This newest moving bed Houdriflow cat cracker has supplanted a fixed bed unit with maximum utilization of existing equipment and minimum disruption of normal operations. The Houdriflow unit stands on 19,000 linear feet of pilings driven to an average depth of 55 feet and capped by a 6-foot thick slab of concrete. Its tower is designed to withstand winds up to 135 miles per hour.

Fast Moving Catalyst. An innovation on the Houdriflow unit was a continuous bulk handling system which takes the pelleted catalyst from railcars to the top of the main storage vessel by means of a high-velocity air stream. The new method was designed by Kaiser Engineers and replaced the slower and more costly bag system or mechanical bucket elevator system. The new all-weather system was designed to move 7½ tons

Who's Building . . .



Sarnia Plant Reports Progress—

Construction work is progressing rapidly on the Houdriflow cat-cracker at Sun Oil Company's new refinery located several miles outside of Sarnia, Ontario, Canada.

This integral reactor-kiln type unit, rated at 11,500 barrels daily, is designed to process gas oils from mixed Texas-Louisiana or Canadian crudes. The unit will circulate clay catalyst at a rate of 300 tons per hour.

Houdry Process Corporation designed, licensed, and partly engineered the catalytic unit, while Catalytic Construction Company is handling construction and the balance of the engineering.

of catalyst per hour, moving the pellets at a rate of 30 feet per second.

Third Expansion. Completed in 1945 by the government for increasing the supply of aviation gasoline, the Texas City refinery is undergoing its third major expansion since its purchase from the Defense Plant Corporation in 1948. The first two improvements to the property were the addition of 1,000,000 barrels of storage and 30,000 barrels of topping facilities.

EMPRESA COLOMBIANA Gives Foster Wheeler Refinery Work

Foster Wheeler Corporation of New York has been contracted by Empresa Colombiana de Petroleos for construction of new units which will increase the crude capacity of the refinery at Barrancabermeja, Colombia, from 22,500 to 30,000 barrels a day.

Principal units in the expansion program are a 30,000-barrel-a-day combined topping and visbreaker, a 19,215-barrel-a-day combined fluid catalytic cracking and vapor recovery unit, a 1200-barrel-a-day sulfuric acid alkylation unit, a 25-ton-a-day sulfuric acid recovery plant, and a 10,150-barrel-a-day gasoline caustic treating unit.

Auxiliary plants, including a new generating plant, and installation of 1,100,000 barrels of new storage capacity are included in plans.

INDIANA STANDARD Plans Construction of World's First New-Type Hydroforming Unit

Plans to build a large new-type fluid catalytic hydroforming unit— the first of its kind in the world—have been announced by Standard Oil Company (Indiana). The new unit is to be installed at Standard's Whiting, Ind., refinery.

The 200-foot high unit will change 30,000 barrels a day of low-octane naphtha into high-octane hydroformate, which will be blended with other gasoline stocks.

Construction is scheduled to start later this year, with completion expected by the end of 1954. The M. W. Kellogg Company is prime contractor.

The new unit, the first "Orthoflow" type hydroformer ever built, will have the catalytic reactor and regenerator in vertical alignment. Because of this feature, catalyst will be required to travel only in a straight line between the reactor, where it will come in contact with the naphtha, and the regenerator, where it will be purified before again meeting fresh naphtha. Both catalyst and feed stock will flow continuously.

This unit will hold about 500 tons of a special molybdena type catalyst so finely divided that it acts as a fluid. Because of the thick steel needed to withstand the high operating pressures required, the reactor will be one of the heaviest vessels ever made for an oil refining process.

The hydroformer will be built near the refinery's two present, large fluid catalytic cracking units which process gas oil into high octane gasoline. These will continue operating, as will an older fixed-bed hydroformer, in which the feed stock is passed through a stationary bed of catalyst. Off-site facilities also will be built to integrate the new plant's operations.

COLOMBIAN GROUP Urges Construction of New Refinery

A Colombian government committee which was appointed early this year to study Colombia's oil situation has recommended construction of a new 25,000-barrel-a-day refinery on the Caribbean Coast. Other committee recommendations: encouragement to new companies to enter the marketing field, and all possible assistance by the government to private exploration and development.

Private capital, the committee said, should be sought to build the new Caribbean refinery, but if private financing is not found, then the government should provide the necessary funds.

However, at the same time the committee's report recognized that investment in refineries and pipe lines offers less return than many other enterprises in Colombia and said that steps should be taken by the government to encourage such investments.

The proposed plant would supply the northern western parts of the country which are now importing products from Aruba.

Although current consumption is less than a quarter of present crude oil production of about 110,000 barrels a day, Colombia is forced to import nearly half the products it needs. This situation is due to the fact that the country's only large refinery at Barrancabermeja can supply economically only the central and southern parts of the country. There is also a disparity between the refinery's production of individual products and the country's requirements.

In its report the committee noted that the modernization program now being carried out at Barrancabermeja will contribute towards solving this problem. But, the committee said, climbing petroleum demand will make a second large refinery necessary. (See related item on Barrancabermeja expansion at left.)

GREEK GOVERNMENT Seeks Proposals on Planned Refinery

Detailed proposals for establishment and operation of an oil refinery in Greece have been requested by the Greek gov-

See GREECE, Page 180

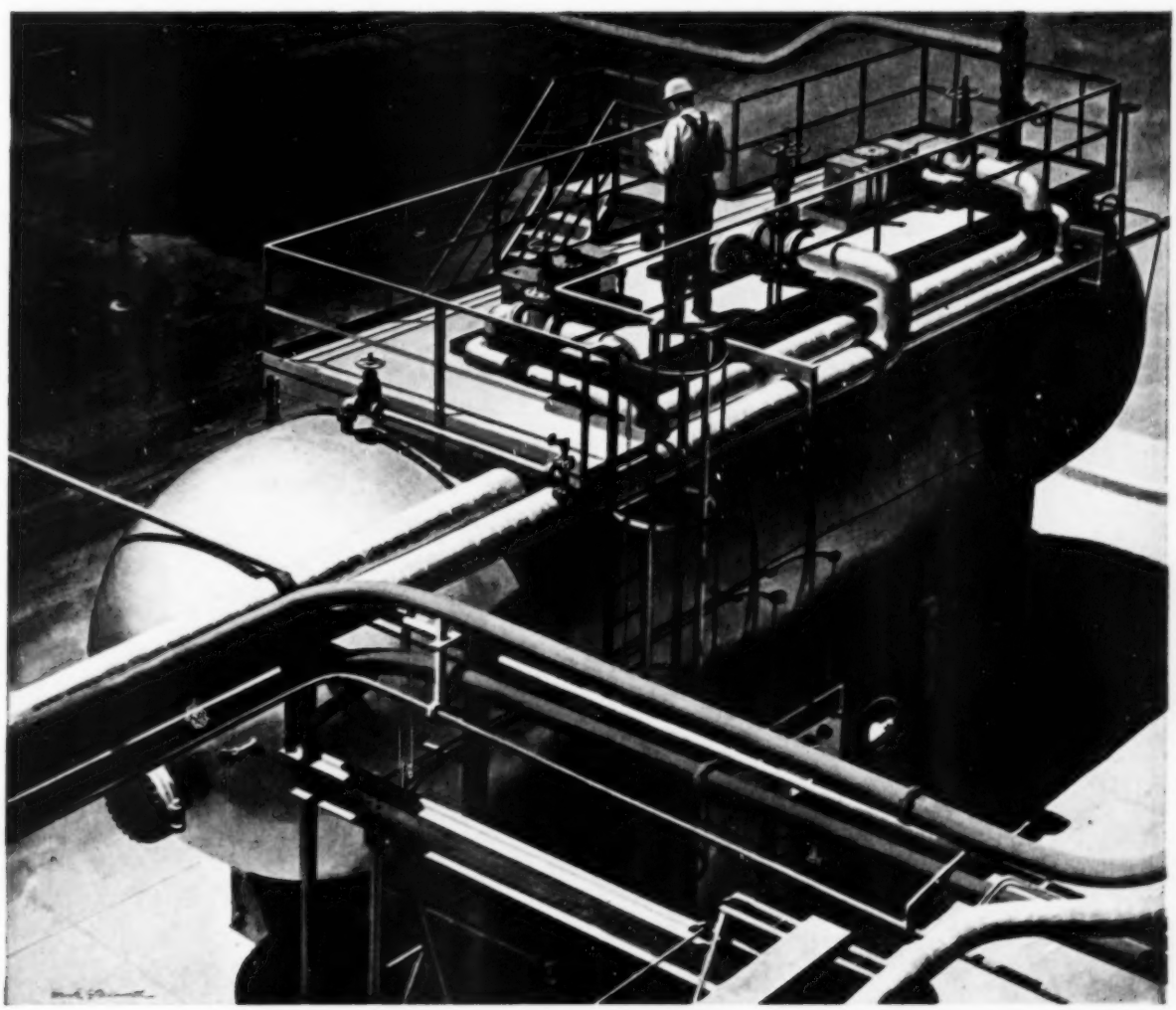
Construction Boxscore Starts on Page 189

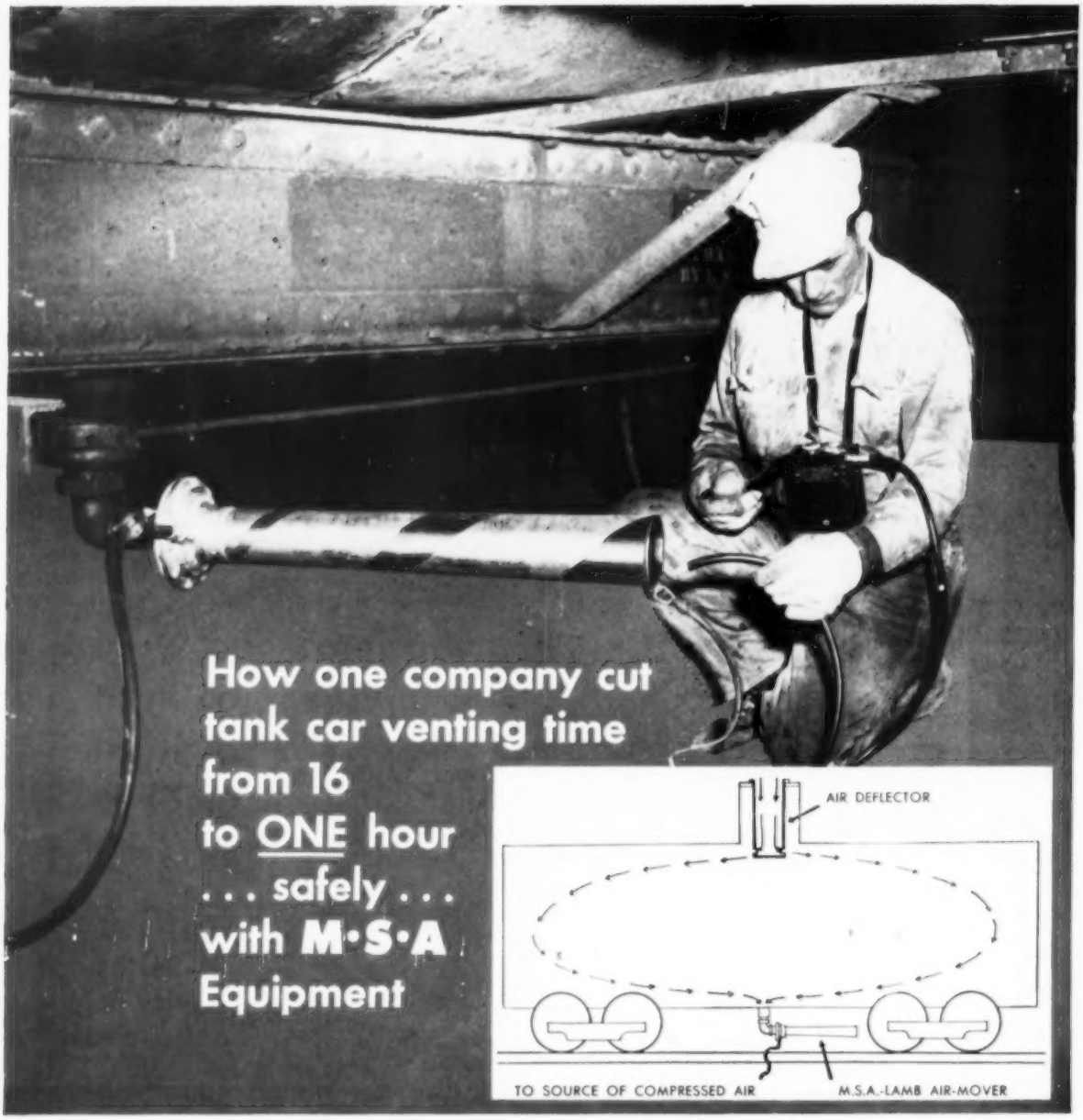
We have "salesmen" on 3 continents...*our customers*

In Europe, South America and throughout North America . . . wherever refiners require unqualified results in the treatment of petroleum emulsions . . . Howe-Baker custom built installations will be found meeting the most exacting demands. Because of this consistent performance Howe-Baker customers become our best salesmen. Refer your desalting problems to us.

SPECIALISTS IN PETROLEUM EMULSIONS

HOWE-BAKER CORPORATION
ESPERSON BUILDING HOUSTON, TEXAS




How one company cut tank car venting time from 16 to ONE hour . . . safely . . . with M·S·A Equipment
AIR DEFLECTOR
TO SOURCE OF COMPRESSED AIR
M.S.A.-LAMB AIR-MOVER

Knocking fifteen hours off the job time for freeing tank cars of explosive vapors and gases and bettering the safety factor at the same time might sound like magic, but it's just routine practice for a large gasoline manufacturing company.

The line drawing above diagrams the how-it's-done story. An M.S.A.-Lamb Air-Mover is connected to the bottom outlet of the tank car. Compressed air, forced through the "bell," expands at high velocity and produces a powerful suction effect. Air is sucked into the tank through the dome opening where a special deflector directs the air stream to both ends of the tank. Vapors and gases are gathered up and exhausted through the outlet horn of the Air-Mover. The expelled air stream is tested at 5-minute intervals with the M.S.A. Explosimeter, a portable device for detecting the lower limits of combustibles. Venting is continued until the Explosimeter reading is zero.

If you are concerned with removing vapors and gases from vessels, this M.S.A. equipment team can help you do it faster, with greater safety. Write for complete details.

MSA
SAFETY EQUIPMENT HEADQUARTERS

Call the M.S.A. man on your every safety problem . . . his job is to help you.

MINE SAFETY APPLIANCES COMPANY
BRADDOCK, THOMAS AND MEADE STREETS • PITTSBURGH 8, PA.
At Your Service: 76 Branch Offices in the United States

MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED
Toronto, Montreal, Calgary, Winnipeg, Vancouver, New Glasgow, N.S.
Representatives in Principal Cities in Mexico, Central and South America
Cable Address "MINSAF" Pittsburgh

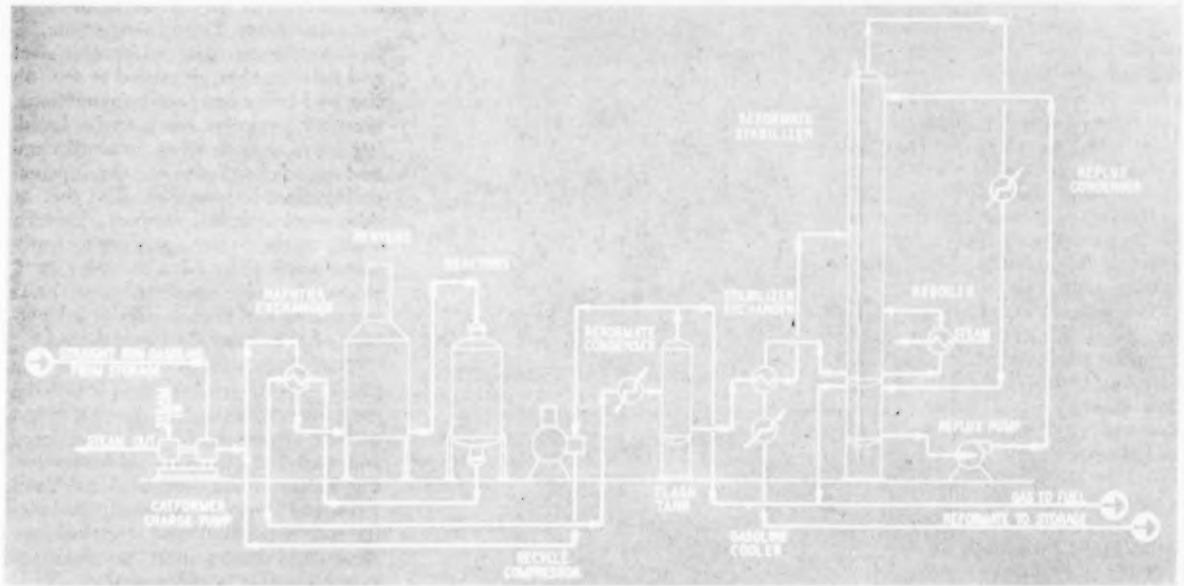


Figure 1. Flow diagram of a catalytic reforming unit.

Short Cut Estimating of Processes

From the private files of a veteran engineering contractor come these methods and data for preparing "quick" estimates of process units.

J. F. Gilmore, Jr., Blaw-Knox Company, Tulsa

MOST IMPORTANT decisions in the industry are based on the answer to this question "How much does it cost?" Engineers, plant operators, management, investors and especially engineering contractors must have readily available an accurate method of calculating the approximate cost of process units in the minimum of time with the minimum of information. The methods described below can be employed to good advantage for determining the close approximate cost of many processing units.

Certain essential information must be assembled and detailed in order to arrive at a preliminary cost with any degree of accuracy. Items such as type of process, plant capacity, process flow diagram, site location, equipment sizes or capacity, materials of construction, equipment layout, auxiliaries, utilities, availability of labor and construction facilities must be weighed carefully. The accuracy of the cost estimate is somewhat proportional to the time and details available and, further, since the degree of details, in turn, are somewhat proportional to time available, it resolves down to the fact that time can be the essence.

This approximate or short cut method for estimating plant cost has been developed from the study of detailed cost estimates of various sizes and types of processing plants and the actual costs of successfully completed plants. These cover a relatively complete sample of the processing units utilized to make up the modern refinery of today.

The elements which go together to comprise a completed plant are broken down into classifications of principal items of equipment, tangible material, direct field labor, intangible material and labor, engineering, and the contractor's overhead and profit.

Costs of the principal items of equipment are usually easily obtained. And, since for similar types of processing plants of various sizes the costs of the tangible materials, direct field labor, intangible materials and labor etc. are relative to the cost of the principal items of equipment, a ratio or percentage of the cost of these items to the cost of the total principal items can be established.

Once these percentage factors have been established, a brief classification of the types of processes with their respective factors can then be made to reveal close approximate costs of an entire field of processing plants of

most any size or capacity.

I. Basic Method

The short cut method can by no means replace the preparation of the detailed cost estimate which must be made by the contractor for bidding purposes. For the contractor it can only serve as an orientation figure. The utility of the method, for members of other phases of the industry, is in the low man-hour requirements for its preparation and the clear insight given of the material, field labor, and construction requirements.

The principle and procedure can best be demonstrated by an example. Suppose the cost of a Catalytic Reforming Unit is required. From the flow sheet, Figure 1, the principal items of equipment can be tabulated and classified as to type of equipment. To carry the example to more detail, a classified item list with what can be considered or defined as "principal items" is shown on Table 1.

After the item list and preliminary specifications of this equipment have been established, a few letters, telephone calls, cost records and/or estimates can resolve a total cost for the principal items as shown on Table 2.

Referring to this table, Item A, the principal items total is $288,000.

Other Material—The "other material" is broken down under Item B of this same table. This break-down specifically covers the piping, structural, electrical, insulation, painting and miscellaneous material requirements for the job.

Based on past experience with this type of unit, the percentage of the total principal items represented by the piping material cost is 16.0 percent. This factor is calculated to include all process, compressor, fuel gas, air, water, steam, drainage, and relief pipe, valves and fittings necessary to effect a complete and operable plant within the specified minimum plot boundary limwater, treating, or storage facilities, such as may be required to facilitate a complete and operable unit has not been included. Such would consist of piping for the steam generation unit, water, treating, or storage facilities. These, naturally, could not be established at this point due to inherent variations and flexibilities of such services.

This piping material also includes the cost of some shop fabricated alloy piping. One of the specifications de-

TABLE 1
PRINCIPAL ITEMS

1. **Vessels**—Columns, Towers, Tanks, Drums, Internal Linings, Trays, Caps, Raschig Rings, etc.

2. **Heat Exchangers**—Shell and Tube, Finned Tube, Double Pipe, Pipe Coils, Atmospheric Sections, and Air Cooled Sections (including Drivers)

3. **Pumps** (Including Drivers—Motor, Turbine, and Engine)—Centrifugal, Turbine, Rotary, Reciprocating, and Power

4. **Compressors, Blowers and Fans** (Including Drivers)

5. **Heaters**

6. **Cooling Towers**—Atmospheric, Forced Draft, and Induced Draft (Including Fans and Drivers)

7. **Mechanical Miscellaneous**—Elevators, Hoists, Cranes, Conveyors, Cyclones, Ejector, Eductors, etc.

8. **Instruments**—Temperature, Pressure, and Flow Indicator, Recorder and Controller Instruments and Panel Board

9. **Structures**—Main Supporting Structures for Equipment

10. **Building**—To house Compressors, Blowers, or Instrument Panel

11. **Electrical Equipment**—Starters and Push Buttons

12. **Freight**—Freight on all Principal Items not quoted with freight allowed

unit states that all piping transferring veloped for the piping for this type hydrogen-rich fluids operating at temperatures greater than 500 F. shall be of minimum 2¼ percent chrome 1 percent molybdenum.

The structural material account has been broken down into two sub-items:

TABLE 2
Catalytic Reforming Unit

A. Principal Items:			
Vessels		$ 47,000	
Heat Exchangers		101,000	
Pumps		8,000	
Compressors		45,000	
Heater		50,000	
Misc. Mechanical		1,000	
Instruments		17,000	
Structures		3,000	
Electrical Equipment		4,000	
Freight		3,000	
Total Principal Items		$288,000	$288,000
	Percent TPI		
B. Other Material:			
Piping	16.0	46,000	
Structural:			
Concrete	3.5	10,000	
Supports, Ladders, Platforms, Etc.	1.1	3,000	
Electrical	3.6	10,000	
Insulation	6.3	18,000	
Painting	1.2	3,000	
Misc.	0.5	1,000	
Total Other Material	32.2	$ 91,000	$ 91,000
Total Direct Material (TPI + TOM)			$379,000
C. Total Direct Field Labor	26.0%		$ 75,000
D. Total Indirect Cost	18.0%		$ 52,000
Total Direct and Indirect Cost	176.2%		$506,000
E. Engineering, Overhead, Fee and Contingency	(23.0%)		$116,000
Total Job Cost			$622,000

concrete and supports, ladders, platforms, etc. The factor established for the concrete is 3.5 percent of the total principal items. This concrete material includes the necessary reinforcing steel and form lumber, delivered to the job site, and is for equipment foundations, grouting, supports, piers, curbs, building floors, pipe trenches, sidewalks and underground red concrete envelope encasing electrical conduit. The cost of other steel including supports, ladders, safety cages, stairs, platforms, walkways, grating, handrails, pipe stanchions, bracing, brackets, clips, bearing plates, and anchor bolts is 1.1 percent of the Total Principal Items.

The electrical labor is one of the phases of the construction which in most every instance can be performed to best advantage by an experienced and qualified electrical subcontractor. The factor of 3.6 percent of the Total Principal Items consequently includes the cost of the labor and electrical construction supplies, both tangible and intangible, by a subcontractor. This factor also includes all the electrical material such as conduit, wire, conduit and wire fittings, lighting fixtures, receptacles and lighting transformers. It does not include, however, the electrical equipment such as starters, pushbuttons or lighting panels which are a part of the principal items. It is based on receiving the protected power lines at the plot boundary in underground conduit at operating voltages.

Insulation also is one of the items which in most instances may also be performed to best advantage by a subcontractor. The factor 6.3 percent of the Total Principal Items covers all material, labor and subcontractor's cost for the insulation work. All vessels, heat exchangers, pumps, turbines, piping and miscellaneous equipment are insulated and weather-proofed where necessary for heat conservation, temperature control or safety consideration. The insulation of vessels is of the block type fastened with metal bands, covered with insulating cement on wire mesh and weather-proofed with corrugated aluminum sheeting. Insulating for the piping is a molded sectional type fastened with metal bands and weather-proofed with corrugated aluminum sheeting. For this type unit the internal insulation for the reactors is included under this factor. The steel lining, a part of the fabricated vessel, is included with the principal items.

The painting factor of 1.2 percent of the Total Principal Items for this method covers both the labor and material required for painting. This is not to infer that the painting could best be handled by a subcontract. This deci-

Economics

sion varies widely from job to job and with contractor to contractor.

This factor is based on painting all structural steel; building interiors where required; and all uninsulated vessels, equipment, and piping; with one base or prime coat and one finish coat of an appropriate paint for the services involved.

The miscellaneous, true to tradition, is the catch-all, compensating for our lack of foresight or inability to provide the necessary categories or classifications. Be that as it may, the average calculated figure for this item is 0.5 percent of the Total Principal Items. These miscellaneous items include crushed stone or chat for certain paved areas; expansion joint material for floors, curbing, foundations and sidewalks; and tie wires.

Direct field labor expressed as 26.0 percent of the total principal items is defined to include the cost of all manual and craft labor; labor and craft foremen or supervisors necessary to directly perform all excavation; concrete work; structural steel and equipment erection; instrumentation; field pipe fabrication; inspecting and testing.

It does not include the labor necessary for temporary facilities, equipment and general supervision which is a part of the total indirect costs represented by 13.0 percent of the total principal items for this unit. All construction projects have in essence three classifications of labor. One is the direct installation labor, as previously defined. Another is the construction facilitating labor for the temporary buildings, temporary utilities, the construction equipment repairs, routine clean up, and warehousing. The third is field management labor which consists of the general construction superintendents, field engineers, accountants, field clerks, and field office personnel as may be required. The cost of the construction facilitating labor and the field management labor items plus the cost of other items, some of which cannot tangibly be classified as material, are defined as the total indirect cost. These other items subsequently defined in more detail, are as follows: The materials necessary for the temporary buildings, temporary construction utilities within the plot boundaries, equipment rental, small tools, construction supplies, field office supplies, telephone and telegraph, travel and subsistence for supervisory field personnel, workmen's compensation, insurance, and taxes.

Complete construction facilities including temporary buildings and temporary utilities have been included as a part of the basic requirements in establishing the factor for the total indirect costs, even though in actual practice, especially when adding new processing units onto existing plants, some temporary building may likely be available. Similarly it is often that the temporary utilities are made available at some point considerably off the plot area. If such is the case, appropriate cost adjustments must be made to bring them to the plot boundary from whence they are covered by the factor.

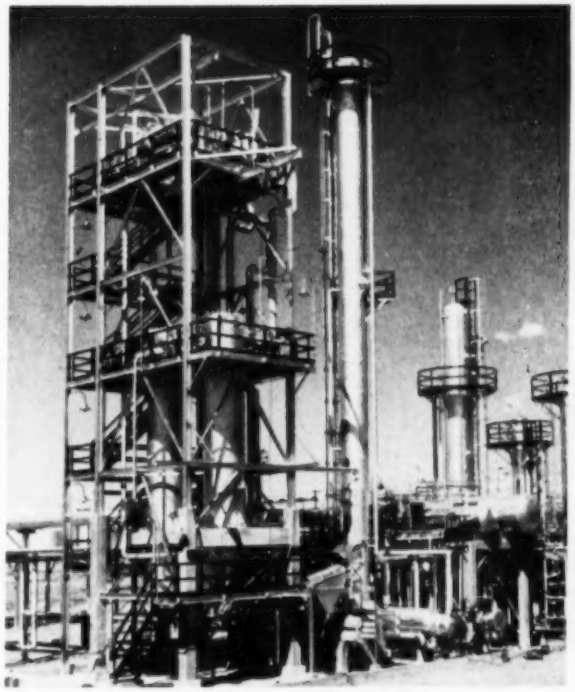


Figure 2. Photo of catalytic polymerization unit showing the reactors in a structure.

Equipment rental, small tools, and construction supplies necessary to perform and complete all of the construction, installation and erection work include, respectively, such typical items as trucks, cranes, stiff legs, welding machines, and winches; wrenches, hammers, saws, electric power tools, picks, and shovels; acetylene, oxygen, water, oil, gasoline, welding rod, tarpaulin, nails, and cribbing.

Up to this point, certain major items of the total other material, the total direct field labor, and the total indirect cost have been broken down with their respective percentage factors of the total principal items. Obviously it is not necessary to follow through each category of these break downs in order to arrive at the total direct and indirect cost since the sum of these percentages plus 100 percent will give a factor which when applied to the total principal items will give the total direct and indirect cost. However, there are definite advantages in following through with the break down if the scope of the proposed project is reasonably clear and if the total principal items are reasonably accurate. Since the scope of the basic break down herein has been specifically defined, the estimators can vary the percentages for certain specific items to suit the individualities of the project.

Engineering, Overhead, Fee and Contingency—The manner in which engineering, overhead, and fee are defined and recovered by engineer-contractors is not standard and varies between the firms rendering these services. In order to define the basis for the established costs of these items, they will be enumerated in detail.

The scope of the engineering required for this and other similar projects covers the preliminary engineering consisting of material and utility balance, process flow diagrams, functional layout, description of the process, item lists, brief specifications, progress schedules and cost estimates; and the detail engineering consisting of final working drawings, specifications, and bills of material, sufficient for use in procurement and construction. These include the following:

A. Engineering layouts, plot plans, and flow diagrams of process and util-

TABLE 3

PROCESS / ITEMS	Crude-Vacuum Unit	Gas Plant	Catalytic Cracking Unit	Catalytic Poly Unit	Catalytic Reforming Unit	HF Alkylation Unit	Delayed Coking (Mechanical Decoking)	Delayed Coking (Hydraulic Decoking)
A. Total Principal Items	TPI	TPI	TPI	TPI	TPI	TPI	TPI	TPI
B. Other Material:	Percent TPI	Percent TPI	Percent TPI	Percent TPI	Percent TPI	Percent TPI	Percent TPI	Percent TPI
1. Piping	27.1	29.0	28.2	22.0	16.0	29.0	19.5	28.5
2. Structural:								
a. Concrete	5.9	6.7	6.1	6.3	3.5	3.6	5.8	6.8
b. Steel Supports, Ladders, Platforms, etc.	2.1	3.4	3.1	1.8	1.1	2.2	4.1	4.0
3. Electrical	2.3	5.0	4.5	5.3	3.6	2.5	7.1	6.8
4. Insulation	15.8	8.3	14.6	7.4	6.3	8.0	9.6	9.1
5. Painting	1.5	1.5	1.6	1.7	1.2	1.8	1.6	1.5
6. Miscellaneous	.5	0.5	0.5	0.6	0.5	0.6	0.8	0.8
Total Other Material	55.2%	54.4%	58.6%	45.1%	32.2%	47.7%	48.5%	57.5%
Total Direct Material (TPI+TOM)	155.2%	154.4%	158.6%	145.1%	132.2%	147.7%	148.5%	157.5%
C. Total Direct Labor	39.8%	36.1%	39.5%	28.5%	26.0%	40.0%	35.0%	37.1%
D. Total Indirect Costs	23.8%	23.9%	24.0%	23.4%	18.0%	25.1%	22.0%	24.0%
Total Direct and Indirect Cost	218.8%	214.4%	222.1%	197.0%	176.2%	212.8%	205.5%	218.6%

ity flows, including basic flow data and line sizes.

B. Vessel drawings showing size, nozzles and orientation.

C. Specification and certified prints of all heat exchanger equipment.

D. Specifications and certified prints of all mechanical equiment.

E. Specifications and certified prints of all instruments.

F. Detailed piping drawings for all process, compressor and utility piping.

G. Detailed drawings of all supporting structures, ladders, platforms and walkways furnished and/or erected by the contractor.

H. Drawings of all foundations required for equipment.

I. Structural and architectural drawings for the buildings.

J. Electrical drawings for all electrical power, control and lighting equipment.

K. Plans, details of area surfacing.

L. Checking shop drawings and certified prints submitted for approval by vendors and subcontractors.

M. Bills of material, material status report, progress schedule, and divisions of work.

N. Services of a competent project engineer to serve as liaison between the customer and contractor and to coordinate engineering, procurement and construction.

O. Provide all necessary cost estimating services.

P. Inspectors and engineers to check, inspect, and test shop fabricated items and equipment, and/or witness shop testings as required or specified.

Q. Furnish an operating engineer to witness and supervise the final testing and initial start-up.

The engineering includes cost of the actual straight time salaries paid only to those engineering department employees who are classified as draftsmen, designers, and engineers, plus a factor for engineering overhead cost.

The engineering overhead cost consists of engineering expense for such matters as salaries of officers for the time devoted to the general supervision of the engineering work; all clerical, filing, mail, stenographical and accounting related to engineering; drafting room supplies; depreciation of drafting room furniture and equipment; payment to engineering department employees for vacation time and sick leave; office supplies; office space; utilities and other expenses related to engineering.

Obviously a percentage factor for engineering will vary if some of these overhead costs were carried under other accounts such as indirect costs or general administration overhead and if stenographers, filing clerks and accountants are required to prorate their time to the specific various projects or customers.

The overhead is the general administration cost in connection with the performance of the procurement, construction and numerous other expenses which can not be allocated to the specific jobs although essential to the performance thereof.

The fee or profit, naturally, is the expected net gain for services rendered.

The contingency is the chance factor tailored for the specific application. Generally the contingency is to protect the contractor in cases of omissions or errors in his bid, unfavorable weather conditions, and variations in the efficiency of field labor. The contingency factor will vary with the season of the year, type of contract, type of process, scope of work, escalation coverage, and with the contractor's attitude toward risk. One method of calculating the contingency factor is to carefully weigh each account or breakdown in the estimate and allocate the actual dollars for possible over-runs and/or escalation. This can be expressed as a factor if so desired.

The percentage factor for the total of engineering, overhead, fee, and contingency, contrary to the other factors which are taken as a percentage of the total principal items, is taken on the total direct and indirect cost. Depending on the contractor, the competition, risks involved, location, information available, familiarity with the type job, the type of contract proposed, and the time allowed for the estimate, the percentage factor for engineering, overhead, fee and contingency normally prevails in the range of 15 to 30 percent. For this example case an average value of 23 percent has been used.

II. Factors Affecting Cost of Plant

There are certain factors affecting the cost of plants, which are self-explanatory and readily predictable; and there are those factors of uncertainty which can be classified more as the abstract. To analyze all the factors of either of these classifications alone would be a sizeable project. The major factors, however, can be discussed briefly. The effect of type and size of the process unit cost can be most readily demonstrated by Table 3.

These factors in Table 3 are typical for the various refinery units commonly encountered. It is noticeable that the piping factor is high for the processing units which handle large quantities of liquid or gas for recycling, refluxing, and pumping. Such is the case where the processing units are primarily a fractionation unit. The factor for piping for these type units follow an approximate average of 28 percent of the total principal items.

Some of the processing units which have a similar liquid or gas handling situation reflect a lower percentage factor for piping due to an increased cost of total principal items such as may be the case where a steel structure is advantageous or required. This can be exemplified by the picture in Figure 2. The piping cost also may be appreciably high as would be the case for a unit where the cost of the compressors increase the cost of the total principal items and thereby effect a lower piping percentage of these total principal items.

The catalytic reforming unit, for instance, consists of compressors and expensive alloy reactors, heat exchangers, and heaters plus the other equipment comprising the principal items, which indicate a relatively low percentage for the piping even though some of the piping is alloy.

Economics

There are essentially no steel structures required for this unit except a compressor shed. The piping and general construction are relatively simple.

One of the other outstanding factors in the other material which might warrant explanation is the extreme variations encountered with insulation factors. For example, the insulation on catalytic cracking units averages 14.6 percent; and 6.3 percent on the catalytic reforming units. The catalytic cracking unit has a large insulation job on the reactor; and the kiln or regenerator is lined with a refractory, plus all the piping insulation. Couple this with the fact that much of the labor is performed at high elevations and this factor becomes considerable. The insulation for the catalytic reforming unit reactors is an internal castable refractory; and since the entire process is a high-temperature unit, an excessive amount of insulation on piping and exchangers is required. The fact that the equipment comprising the principal items is so expensive, as stated previously in reference to the piping cost for this unit, causes this factor to appear low in comparison with other similar insulation work.

As a result of the current interest in coking, the relationships have been presented for the delayed coking unit with both mechanical and hydraulic decoking facilities in Table 3. The differences here are synonymous with the type.

The geographical location of the plant has marked influence on the cost. Transportation, freight, and availability of labor are the most obvious factors here. It is readily understandable that the cost of a plant in Texas might vary considerably from the cost of an equal capacity plant of the same type process but located in, say, northwestern Montana. There is the basic difference of weather condition, which could warrant the use of a different cooling facility. There is the winter protection angle requiring an excess of steam tracing and process equipment enclosure. Then on the other hand, plants of identical process design in the same climatic locale can vary tremendously in cost as a result of variations in allowable soil bearing.

Labor availability and wage rates are always an understandable factor which can appreciably affect the cost of the units. In some locations, it is necessary to work the job on overtime in order to procure the required labor to complete the project for the best interest of both the contractor and the customer. In such an instance, to convert a project from the usual 40-hour week to a 48-hour week would increase the actual labor cost by 8 1/3 percent.

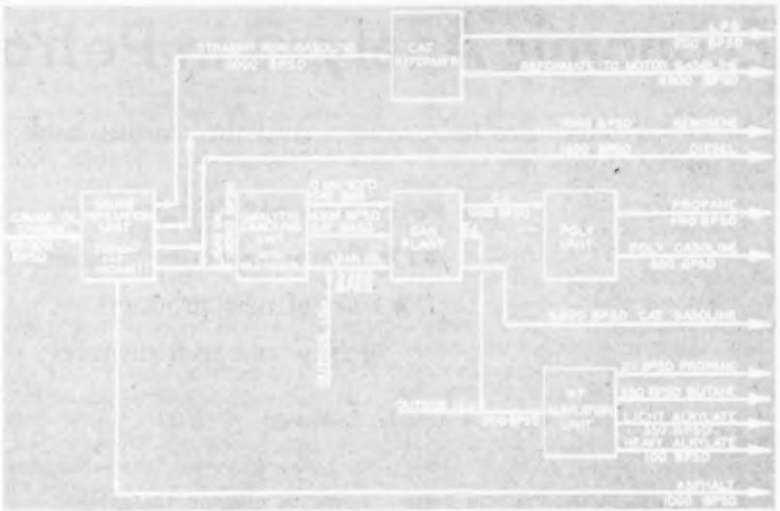


Figure 3. Block diagram of a typical 25,000-barrel-per-stream-day refinery.

III. Typical Refinery

Figure 3 shows the block diagram of a typical 25,000-barrel-per-stream-day refinery. In order to arrive at the approximate cost of the total plant certain details were required. First the flow diagrams were developed, then preliminary specifications were prepared for the principal items.

Actually, for the preparation of estimates by this short cut method, the flow diagram is not absolutely essential if specifications of the principal items are available in good order, but since it should be or probably has been prepared in order for the process engineer to arrive at the preliminary specifications of the equipment, the flow diagram can serve aptly to contribute to the accuracy of the estimate. For the more detailed procedures of estimating the cost of the processing units, the flow diagram is an absolute essential.

The procedure in handling approximate cost estimates for the typical plant is essentially the same as demonstrated with the example of a catalytic reforming unit. Each unit must be handled as a separate unit utilizing the respective factors on Table 3 through the total direct and indirect cost for each unit. At this point, the proposition should be analyzed to establish the factor for the contractor's engineering, overhead, fee and contingency to be taken on the sum of these total direct and indirect costs, bearing in mind that a volume of work such as is manifest in this cases hould warrant a somewhat smaller percentage for the engineering, overhead and profit than was used on the example case.

IV. Conclusion

In conclusion, it should first be emphasized that no attempt has been made to cover the cost of service facilities such as steam generation, cooling towers, water, treating, or electrical power generation and, second, that the factors proposed are explicitly for the type units classified.

Certain factors which affect the cost of a plant may warrant a change in the percentages of the total principal items presented herein. Engineers concerned with processing units other than those specifically covered herein, should be able to utilize the general method and establish similar percentage factors more adaptable to their specific purpose by recognizing that type of process in question which can be keyed to a similar process unit for which the data has been organized on Table 3. That is, if much piping, supplemental heat exchange and fluid handling equipment is required, the piping and total other material accounts will be high. Conversely, if the unit is such that the major items ofequipment constitute the major cost, these accounts will be lower.

These factors have been presented from the engineer-contractor viewpoint to cover a defined basis or condition. Finally, it should be understood that the agreement of any estimated cost with the actual cost will depend upon the skill and judgment of the estimator. Skill implies the accurate use of good estimating methods and judgment implies the correct visualization of the work as it actually will be done.[1]

[1] Pulver, H. E.; Construction Estimates and Costs, 2nd Edition, McGraw-Hill Book Co., Inc., New York and London, p. 1 (1947).

Cost Estimating

Economic Analysis in Petroleum Refining

Here are the answers, and the reasons back of them, on how to determine the dollar values of:

- **Payouts on new installations**
- **Optimum operating methods**
- **Cost of new products**
- **New research projects**

J. P. Hamilton, Humble Oil & Refining Company, Baytown, Texas

ECONOMIC ANALYSIS in petroleum refining is the application of the common denominator—dollars—to the manpower and materials consumed and the products manufactured in order to establish the most economical manner of conducting the business. Consideration of either factor alone will not determine the preferable course of action. An operation with the lower manpower and material consumption (lower operating cost) is not necessarily the most desirable procedure. Similarly, an operation giving higher yields or production rates is not necessarily a more economical operation. Both factors must be included on a common basis. The only common basis available is a dollars basis. Dollars then represent the yardstick that economic analysis applies to all aspects of a problem to arrive at an answer that gives fair recognition to the economic importance of each factor involved.

General Function of Economic Analysis—Economic analysis is used in petroleum refining in various manners to assist in the production of lowest cost products. It is used in the evaluation of various raw materials as refinery charge stocks and thereby determines the choice of the most economical charge stocks. Indications of the costs of products are determined by economic analysis. Product costs are important in deciding whether to manufacture products for sale at market prices set by competition.

Determining the most economical refining operations using new or existing equipment is an important function of this type of analysis. Economically attractive projects for inclusion in research programs are indicated by economic calculations. The application of economics in these various problems is important in planning optimum future operating programs, maintaining efficient operations for lowest cost products, and developing progressive research programs.

In a modern refinery the application of economic analysis is complicated by the fact that several hundred different products may be produced from one basic raw material—crude oil. Other minor raw materials such as butane and natural gasoline are also involved. Further, the basic raw material, crude oil, may include a large number of different crudes having considerably different characteristics and purchase prices. It is becoming increasingly more difficult for the petroleum refiner to determine which products are prime products and which are byproducts. The economic analyst is constantly faced with the problem of establishing the proper differentials between the costs or values of the various products and raw materials consistent with the amounts of one product which can be produced from another or from crude oil. In this respect, economic analysis in petroleum refining is more complicated than similar problems in many of the chemical and allied industries where one or several raw materials of known costs are utilized to produce one major product.

Economic analysis helps a refiner determine whether he can meet competition. Application of the results of economic analysis by a petroleum refiner will result in an improved competitive position in the industry and may result in increased profits. An economically attractive operation makes more efficient use of manpower plus materials than a less attractive operation for doing the same job, thereby liberating manpower and/or materials for other uses. Therefore, when a refining project is indicated to result in an economic credit, this credit may or may not actually be realized by the refiner because of competitive pressure, but is unquestionably realized by the society as a whole because of the decreased consumption of manpower and/or materials in doing the required job. The more efficient utilization of manpower and materials is an important result from an overall viewpoint.

In considering the application of economic analysis in petroleum refining, the subject can be broken down into the basic tools used, the general approach to solution of problems, and the types of problems encountered.

Basic Tools

Operating Costs—Operating costs of existing unit operations in a refinery can be established by normal accounting procedures. Controllable or direct operating costs consist of direct supervision, operating labor, maintenance and repair labor plus materials, chemicals, fuel, utilities, auxiliary services, royalty or license, and employee benefits. Addition of overhead and burden items, which include depreciation, taxes, administrative and general expense, and other burden items not chargeable directly to the operation, gives the total operating costs of the unit operation. Although the breakdown and distribution of these costs are subject to accounting practices, for a given refinery the total money spent for manpower and materials must be distributed to all of the operations carried out in as fair a manner as possible. The economic analyst must, of course, be acquainted with and use the operating costs in a manner consistent with the method under which the costs were prepared. In addition to the controllable and total operating costs described above, it is often necessary to estimate mar-

Economics

ginal operating costs, which may be defined as the cost of increasing the charge rate or production from a unit already in operation. Hypothetical controllable, total and marginal operating costs for a modern crude oil pipe still are shown in Table 1 for illustration of the items which contribute to each of the three types of operating costs.

Employe benefits may include all expenses that are directly proportional to payroll such as accident benefits, workmen's compensation insurance, vacation pay, holiday pay, sickness benefits, unemployment compensation, old age benefit taxes, annuity and savings plans contributions, etc. Burden and overhead expenses in total operating costs may include the medical department, employe recreation and safety facilities, mechanical shop's overhead, mechanical testing and inspection, laboratory testing and technical services, material storehouse, engineering department, fire and plant protection, accounting, and administrative expenses. As illustrated in Table 1, marginal operating costs are determined by estimating what actually happens to each item of operating cost as charge rate or production is changed. Usually no additional direct operating labor or supervision is required. Maintenance and repair labor plus material per barrel charged can be assumed to be 50 percent of the average unit cost for maintenance and repair. Chemicals, fuel, and utilities are usually increased in direct proportion to charge rate. Costs of auxiliary services such as cooling towers, railroads, and fuel gas distribution are included to the extent that a change in charge rate affects these costs. In the case of overhead or burden items, a marginal increase could be included in the estimated controllable and marginal operating costs.

Each of the three different types of operating costs are used where applicable in the various types of economic analysis problems encountered. Total operating costs are used for the total expense incurred as a result of installation and operation of a new unit. This type of cost is also used in establishing total costs of products from existing units as will be discussed later. Controllable operating costs are used in estimating the cost incurred in starting the operation of existing idle units or saved when shutting down existing operating units. Marginal operating costs are, of course, applicable to varying charge rate or production of existing units which are already in operation.

It is often necessary to estimate operating costs of proposed new equipment which is greatly different from existing equipment on which operating costs are known. This is done by first establishing the direct operating manpower, investment, fuel, chemicals, and utilities required for the new unit; from these basic quantities the operating costs are built up by applying the proper factors determined from experience on existing units to these quantities to arrive at the estimated controllable and total operating costs of the new equipment. If these basic quantities are not available, it is possible to approximate the operating costs of new units by applying a percentage determined from experience to the investment required for the new unit. This percentage varies with the type of process involved and the size of the unit, but amounts to 25-40 percent per year on investment for the annual total operating cost of commercial size refinery process units such as cracking, polymerization, distillation, or light ends recovery. For example, a fluid catalyst cracking unit might cost $12 million for process equipment at today's construction costs and might have a total operating cost of $3000 to $10,000 per calendar day, which is 24-30 percent per year total operating cost on new investment. Controllable costs in general are about 50 percent of total costs, and marginal costs per barrel charged are about 50 percent of controllable costs per barrel charged. Establishing operating costs represents an important part of the economic analyst's work in the solution of a problem.

Raw Stock Costs and Product Values—The economic analyst must establish values to be applied to raw stocks consumed and products produced in the refining problem involved. Raw stocks consumed may be purchased stocks such as crude oil, natural gasoline, natural gas, butane, lube additives, or any other purchased material consumed in process. These are, of course, debited at their cost. The raw stock consumed or materials produced may also be intermediate process stocks in the refinery which are unfit for sale as such and for which purchase or sales prices are not known. These intermediate process stocks are evaluated in terms of the cost of producing them from purchased stocks or their value in terms of the operations and finished products that can be produced from them in normal refinery processing. Depending on the general situation involved, the finished refinery products from the operation in question can be evaluated on two bases: (1) If a market value or realization basis exists for a particular product, it is assigned a value determined from market quotations for this product. This condition exists if it is possible to sell additional production of this material. (2) If the demand for a given product is being satisfied, this product is on a replacement basis, which means that increasing production of this product by the operation in question will require reducing the production to the original level by variation in other operations and reduction in purchase of raw stocks such as crude oil. Incremental replacement costs of products from crude oil can be calculated for use in evaluating increased production of a product which is on a replacement or fixed production basis.

TABLE 1

Operating Costs—Crude Oil Pipe Still

	Total, ¢ Bbl.	Percent for Marginal	Marginal, ¢ Bbl.
Salaries and Wages:			
Operating	0.40	0	0
Maintenance	0.75	50	0.37
Total Salaries and Wages	1.15		0.37
Material:			
Maintenance	0.40	50	0.20
Chemicals	0.05	100	0.05
Petroleum and Gen. Supplies	0.02	100	0.02
Total Material	0.47		0.27
Fuel:			
Operations	0.80	100	0.80
In Utilities and Auxiliaries	0.25	100	0.25
Total Fuel	1.05		1.05
Utilities:			
Excl. Fuel, Depreciation, and Taxes	0.25	100	0.25
Auxiliary Services:			
Cooling Tower, Pumping, Industrial Units, etc.	0.60	50	0.30
Employee Benefits	0.28	Calc.	0.09
Controllable or Direct Cost	3.80	Marginal Cost	2.33
Burden and Overhead Expense	1.50		
Depreciation and Taxes	1.00		
Total Cost	6.30		

Investments—The investment for existing equipment affects total operating costs of existing equipment as a result of maintenance and repair, depreciation, and taxes being included in total operating costs. The estimated investment for new equipment is necessary in an economic analysis to establish the estimated operating cost of the new equipment. Also, since the economic problem involved in installing new equipment is generally to estimate the rate of return on investment in years or as percent per year, it is necessary to know the new equipment investment required.

Thus, it is seen that the basic tools used in preparing an economic analysis are equipment operating costs, equipment investment, raw material costs, and product values such as

Cost Estimating

either market values or replacement costs.

General Approach in Economic Analysis

In principle, an economic analysis in petroleum refining is relatively simple. It consists of defining completely current and proposed operations and applying dollars to all the differences in operations, investments, raw stocks, and products involved in order to determine whether the current or proposed operations are more attractive economically. In practice, the solution of an economic analysis problem can be complex because the proposed change in operations or the new equipment installation may affect the operation of many other process units in the refinery.

Basis—A very important part of an economic analysis is the establishment of the basis for the analysis, which means defining each aspect of the problem in as exact a manner as possible. A general definition of current and proposed operations must be established. The desired methods of evaluation of raw stocks, products, and operating costs should be determined. It is emphasized that the results of an economic analysis are directly dependent on these factors. For this reason, the statement of the problem should be as definitive as possible regarding these items; however, the economic analyst himself often must fix the basis where it is not stated. It is often true that some of these factors cannot be definitely established; therefore, the economic analysis must then be shown on the various possible bases that may exist. This factor, of course, adds to the complexity of economic analysis in practice.

Material Balance—After establishment of the basis or various bases for the economic evaluation, the next important step is establishment of material balances for the proposed, as compared to the present, operation for the various cases under consideration. The material balance represents the effect of the proposed operation on raw stocks consumed and products produced and is obtained by establishing the detailed effects on refinery products of each current operation that is discontinued or altered and of each proposed new operation involved. This is done stepwise by determining exactly what happens to processing operations as a result of installation of new equipment or variation in operation of the old equipment under the basis established for the analysis. The importance of the material balance cannot be overemphasized. It represents the net effect of the proposed operation on feed stocks and products and, of course, must be in weight balance. Further, the analysis must not only be in physical material balance but it must also be in geographical and chronological material balance. The geographical material balance refers to location of raw stocks, markets, and refineries as these affect transportation charges. The chronological material balance refers to the varying situations for seasonal operations and seasonal storage, the time required for construction of equipment and, of course, is reflected directly in depreciation charges with time on equipment investment. It is necessary for the economic analyst to have a complete mental picture of every change involved in the problem under consideration on a physical, geographical, and chronological basis.

Establishment of Economic Answer—Operating costs are assigned to each operation involved in arriving at the finished material balance. These operating costs may be either total, controllable, or marginal, depending on the specific problem and basis involved. Raw stock costs and product values are assigned to each item appearing in the material balance. The type of raw stock cost or product value used also depends on the specific problem and basis being considered. Combination of the net operating costs and net product credits allows the establishment of the economic answer required in the form of a feed stock value, a product cost, or an economic credit to an operation or an installation. These results are directly dependent on the basis for the evaluation.

The general approach used in an economic analysis may then be summarized as follows:

(1) Define the problem, including establishing the basis as completely as possible.

(2) Establish a material balance for the problem to determine the net effect on raw stock and product quantities.

(3) Assign the proper values to the raw stocks and products shown in the material balance as defined by the basis.

(4) Determine the operating costs for each operation involved in arriving at the material balance.

(5) Combine the product credits and operating costs to arrive at the economic answer required.

Types of Problems Encountered

There is a wide variety of specific probems encountered, but they can be grouped into several general classifications. A number of these general types of problems together with the specific approach to their solution will be discussed in the following paragraphs.

Choice of Raw Stocks—The relative economics of processing in a refinery of various raw stocks such as natural gasoline, different crudes, or other purchased raw stocks may be determined by economic analysis. In this problem the economic analyst attempts to determine the relative values of the various raw stocks as charge to the refinery by processing them in available equipment to finished products, assigning values to these products, determining operating costs of the processing equipment involved, and combining the product value credits and operating cost debits to arrive at the value of the raw stock to the refinery. The basis for the calculation must include: (1) which products can be sold at market value and which products must be maintained constant, (2) market values to be assigned to product sold, and (3) the type of processing equipment available, such as catalytic cracking or thermal cracking, polymerization or alkylation of olefins, etc. This calculation results in a calculated value of each of the raw stocks as charge to the refinery, which can be compared with the purchase prices to determine the order of economic preference of the raw stocks.

It is often desirable to determine the value of incremental crudes as charge to a refinery operating below capacity. In this case the specific equipment available for processing the crude is used and the desired products produced from the crude are limited to those that can be produced with the available equipment. Marginal or controllable operating costs for the equipment utilized are debited depending on which is applicable. The intermediate stocks produced from the incremental crude should be processed in the most economical manner as limited by available equipment. The net products that can be made from the crude are credited at their market prices and operating costs are debited to arrive at the value of the crude as incremental refinery charge.

Cost of Incremental Products—The incremental cost of increased production or production of a new product represents an important type of economic analysis problem. Cost of incremental production is established

by determining the material balance effect of producing this product and establishing the effect on all operations involved. Changes in other salable products are evaluated in terms of market values; operating costs are debited or credited at total, controllable, or marginal levels, depending on the type applicable to the specific problem. Total cost is used where new equipment is involved, controllable where existing idle equipment is utilized, and marginal costs are used when varying the charge rate to units already in operation. Combination of the net monetary effect on other products with the net change in operating costs allows calculation of the cost of the incremental product. This is a very similar problem to the calculation of the value of a material such as butane, natural gasoline, naphtha, or crude oil as incremental charge to the refinery. In general, these incremental values of charge stocks and costs of products represent the true or "out-of-pocket" values, since the actual yields and the actual effect on refinery operating costs for the specific situation involved are established in arriving at these values.

Economic Balance Problems—Economic balance problems to determine the most economical means of operating a given process unit involving the factors usually considered in setting up operating standards represent an important part of economic analysis. Variations in throughput, temperature and pressure, chemical and catalyst consumption, conversion, and other variables are investigated to determine the optimum operating conditions. This is generally done by setting up several cases covering the range of operating conditions to be investigated. The material balance and operating costs for each of these cases are evaluated to determine the operation which gives the greatest economic credit.

Justification of New Equipment—An important part of economic analysis is the justification for capital expenditures for new equipment or revisions to existing equipment in order to obtain increased capacity, better yields or product distribution, lower operating costs, better product quality, or combinations of these factors. As in the previous cases, the justification is calculated by determining the effect of the new equipment on material balance and operations. The material balance of products that can be sold is evaluated in terms of market values and the proper type of operating cost is debited to arrive at the justification for the new equipment. Total operating cost for the new equipment is included. The economic credit is calculated as dollars per year, percent per year on investment, or years required to return the investment.

In the justification for new equipment it is often necessary to consider two or more processes to decide which is the most economical to do a given process job. In comparing two processes which require different investments and result in different economic returns, it is necessary to consider the return on incremental investment for one process over the other to determine which of the two is preferable. The process with the higher investment is preferable only if the return on the incremental investment for this process as compared to the other represents a desirable rate of return. Of course, the return on incremental investments should be used only to decide which is the preferable process for installation; the return on investment for installation of the preferable process should represent the return on the total investment required for this process independent of any alternate process.

Evaluation of Research Projects—In planning research and development programs it is desirable to consider not only projects which are theoretically possible on a technical basis and which will produce desired products, but also projects which appear feasible on an economic basis before extensive laboratory development programs are started. Economic analysis may be applied to a research project early in the program to establish whether the operation would be economically attractive. These evaluations usually involve new equipment and total operating costs are used. The analysis is made similar to those discussed above by determining the material balance effect, debiting operating costs, and calculating the economic credit as the net effect of the two.

TABLE 2

	Yield, Volume Percent	Gulf Coast Cargo Market Value ¢/Gallon
Product:		
Motor gasoline	40	12.0
Kerosine	10	9.0
Heating oil	30	8.0
Fuel oil	15	4.4 ($1.85/B)
Fuel gas	5	2.14(15¢/Mbtu)
Total and average	100	8.87
Crude cost	$2.90 per barrel	6.90¢/gallon
Operating cost	0.60 per barrel	1.43¢/gallon
Total	$3.50 per barrel	8.33¢/gallon
Refinery profit before income tax	22.7¢/per barrel	0.54¢/gallon
Income tax at 52 percent	11.8¢ per barrel	0.28¢/gallon
Refinery profit after income tax	10.9¢ per barrel	0.26¢/gallon

Since this type of analysis is generally made early in the research program, definite investment, yield, and operating costs are usually not clearly defined; therefore, the analyses must include the effect of fairly wide ranges of these items to establish the economic desirability of the research or development for the various possible results that may be obtained. Another important function of an economic analysis of a research project is the determination of the relative economic importance of various factors such as required investment, yields, charge rates, catalyst requirements, product quality, byproduct disposition, and operating conditions so that emphasis may be placed in the research program on the factors of major importance.

Total Cost of Individual Products—The establishment of total cost of individual products in a modern refinery is complicated by the great number of different products produced simultaneously from the crude oil. For this reason refinery product costing is not a simple matter of accounting. Instead, a procedure must be set up to assign fair raw stock and operating costs to the various products. This requires technical knowledge of the refinery yields, operations, and stocks involved. It is necessary that the total cost of total products must be equal to the cost of the total purchased raw stocks plus the total operating cost of the refinery. The problem then involves obtaining an equitable distribution of raw stock and operating costs between the various products.

There is no universally acceptable and accurate method of determining the true cost of the many refinery products produced simultaneously from a single raw stock. Many methods are possible by making certain arbitrary assumptions. A few of these methods will be outlined and the results compared.

It is assumed in a hypothetical example that a refinery is operating producing the products shown in Table 2 from crude oils costing $2.90 per barrel delivered, and that the operating cost of the refinery is $0.60 per barrel of crude charged. If the sales prices of products from the refinery (Gulf Coast-Cargoes) were as shown in Table 2, the refinery would be making a profit before income taxes of about one-half cent per gallon or 22.7 cents per barrel of crude charged. Payment of 52 percent income tax

Cost Estimating

would reduce the profit in this hypothetical case to 10.9 cents per barrel.

The problem arises as to what is the cost of the individual products and what is the profit being realized on each before income taxes. Various arbitrary methods of arriving at the cost of the individual products produced simultaneously from the crude oils are possible; results from some of these methods are shown in Table 3 and are described in the following sections. In all methods considered, it will be noted that the weighted average costs of all products are equal to the crude cost plus operating cost shown in Table 2.

1 In the average unit cost method it is assumed that all products cost the same with the exception of fuel gas, which is given an arbitrary natural gas value in this example. It will be noted that costs by this method bear little resemblance to market values and that motor gasoline and kerosine would cost less than market value while heating oil and fuel oil would cost more than market value. Fuel oil could have been assigned a market value in this method; this would have resulted in increased costs for the other three major products.

2 If it is assumed that the same profit as percent of cost is realized on all products except fuel gas the costs in this column would result.

3 In this case, it is assumed that the same profit as percent of cost is realized on all products except fuel oil and fuel gas, which are assigned costs equal to their market value. Both Methods 2 and 3 result in costs of major products proportional to market values.

4 In the byproduct method, all products except motor gasoline are assigned market values and cost of motor gasoline is calculated by difference. This method results in all profit appearing on motor gasoline. All of the above methods distribute costs in relation to market value of products and therefore do not represent direct costing methods.

5 Total replacement costs are calculated by first processing crude to ultimate or maximum yield of motor gasoline with zero yield of kerosine and heating oil in a hypothetical operation. Total replacement cost of gasoline is then calculated by debiting the cost of the crude oil and the hypothetical operating costs required and crediting the byproduct fuel oil and fuel gas produced at market values. Costs of kerosine and heating oil are then calculated in terms of this gasoline cost by establishing the yield of gasoline, fuel oil, and fuel gas that can be produced from the product in question. Fuel oil and fuel gas are also assigned market values in this calculation and hypothetical operating costs required for the conversion are debited. It will be noted that in establishing these costs it is necessary to process crude, kerosine, and heating oil to ultimate or maximum yield of motor gasoline, which involves cracking of refractory cracked cycle stocks to extinction, which results in poor ultimate yields; however, this method gives costs of total actual production.

6 Incremental total replacement costs are calculated in a manner similar to total replacement costs except that in this method sufficient hypothetical virgin gas oil fraction in the heating oil boiling range is cracked to partial yield of gasoline and cracked heating oil to achieve zero net heating oil production, rather than to crack the actual refractory cracked cycle stocks to ultimate yield. This results in increased ultimate or maximum gasoline yield from the crude, and thus lower gasoline cost. This procedure assumes that sufficient virgin gas oil in the heating oil boiling range is available in heating oil production to allow this to be done. Therefore, this method is applicable to costing incremental production only, and assumes that the marginal means of adjusting gasoline to middle distillate ratio is partial yield cracking of virgin heating oil fractions. Methods 5 and 6 are calculated costs independent of market values except that market values are assigned to byproduct fuel oil and fuel gas.

Comparison of the costs calculated by the various methods with market values indicates that, where market values are used to distribute costs, the costs bear a direct relation to market value. However, since costs by these methods vary with market values, they represent allocated and not calculated costs. This type of costing may be desirable under some situations. The replacement costs are calculated costs independent of market values; however, many arbitrary assumptions are involved in the details of the calculations.

Incremental replacement costs represent a method of costing relatively large increments of marginal production, but are dependent on the marginal conversion process available for adjusting gasoline to middle distillate ratio. To the extent that these costs affect the supply of a given product that can be profitably produced at a given market price, incremental replacement costs probably affect equilibrium market prices.

Other methods of distributing total costs over total products are available; however, these examples show the variation that can be obtained by some of the arbitrary methods. It is emphasized that no single method can be stated to represent true costs. Different methods may be applicable for different situations.

Summary—Economic analysis is used in petroleum refining to establish the monetary credits for changes in products, charge stocks, operations, or equipment to determine the most economical course of action. This approach is important in determining product costs, most economical refining operations using new or existing equipment, and economically attractive research projects. The basic tools used in preparing analyses include equipment operating costs, equipment investments, raw material costs, product market prices, and product replacement costs. Economic analysis in modern petroleum refining is complicated by the complexity of operations and products involved. In solving the economic analysis problem, the analyst must first establish the basis for

See REFINING ECONOMICS, Page 109

TABLE 3

Product Costs (Before Income Tax) Cents Per Gallon

PRODUCT	Yield, Percent	Average Unit Costs 1	SAME PERCENT PROFIT: All Products 2	SAME PERCENT PROFIT: All Ex. Fuel Oil 3	Byproduct Method 4	Total Replacement Cost 5	Incremental Total Repl. Cost 6	Gulf Coast Market Value, ¢/Gal.
Motor Gasoline	40	8.66	11.27	11.21	10.66	11.91	10.87	12.0
Kerosine	10	8.66	8.46	8.40	9.00	8.50	8.40	9.0
Heating Oil	30	8.66	7.51	7.47	8.00	6.50	7.92	8.0
Fuel Oil	15	8.66	4.13	4.40	4.40	4.40	4.40	4.4
Fuel Gas	5	2.14	2.14	2.14	2.14	2.14	2.14	2.14
Total and Average	100	8.33	8.33	8.33	8.33	8.33	8.33	8.87

Economics

Figure 1. Basic Purposes of Economic Evaluations

A. Guidance of research or experimental efforts
B. Guidance for management judgment on capital expenditures
C. Guidance for management judgment in the establishment of pricing policies
D. Guidance to operating management for cost control

Economic Analysis in Chemical Plants

From the conception of a new product idea to eventual marketing, economic analysis specialists call the signals in the chemical industry. This is an analysis of their methods.

A. B. Horn, F. J. Sergeys and W. C. Strader,
Ethyl Corporation, Baton Rouge, La.

EVERY ENGINEERING project must be scrutinized from the standpoint of its economics. The purpose of this article is to review briefly the basic principles and objectives of such an evaluation. The space allotted is too brief to treat in detail any particular phase of the broad subject of economic or financial evaluation. Consequently, primary emphasis will be directed toward analyzing the fundamentals of any economic evaluation. This review will focus attention on some of the more important aspects of the subject, even at the risk of retracing ground already familiar to the reader.

First of all, what is an economic evaluation? Basically, it is a determination of the financial effect on an entrepreneur resulting from following a given course of action in relationship to the financial effect of an alternative course of action.

When applied to a specific engineering project, an economic evaluation may serve anyone of the purposes shown in Figure 1. During the life of a project, evaluations may serve each one in turn.

To illustrate the application of economic evaluation to these four purposes, later on in this presentation the history of a project involving the manufacture and sale of a new product will be traced. We shall consider in more detail at that time how financial evaluations can serve the purposes outlined in Figure 1.

What factors should be taken into consideration in making an economic evaluation? Figure 2 summarizes those cost elements, all or part of which must be taken into consideration in making an analysis.

Whether all of them or only individual ones must be taken into account will depend upon the nature of the project. For example, the introduction of a new product must take all of them into account. On the other hand, the substitution of a new piece of equipment in an existing process may only require the evaluation of the effect of this new equipment on manufacturing cost.

Manufacturing costs as well as packaging, storage and freight charges are of every day familiarity; however, the other cost elements need further definition.

Sales expenses include salaries, operating expenses, and commissions of sales personnel required for selling the product as well as the costs of customer technical services and advertising. It is usually necessary to draw on the experience of the Sales Department in estimating these costs which can vary over a wide range depending upon the nature of the product and its market and the sales volume.

Supporting research cost is the item most frequently overlooked in estimating the cost of producing a new product. In this day and age, it is exceptional when it is possible or advisable to stop research effort on a particular item just because the plant to produce it is under construction.

Not only is it necessary to continue research and development to achieve lower unit costs, but it is frequently necessary to modify and refine the characteristics of the product in order to maintain sales position. In this research minded period, it is highly improbable the production for sale of a new product will not require additional

Cost Estimating

Figure 2. Important Cost Elements

A. Manufacturing costs
B. Packaging, storage and freight charges
C. Sales expense
D. Supporting research costs
E. Capital required and its cost

personnel in the research and development departments.

Capital required and its cost include the expenditures necessary for the plant's physical facilities, working capital, and interest payments on these funds if borrowed capital is used. Working capital consists of inventory value of spare parts and machinery, raw materials, and finished products and accounts receivable on product sold but for which payment has not been received.

The economic evaluation as a guide to research or experimental effort. To demonstrate the functioning and utility of the economic analysis, let us assume that the research chemist has produced a new material for which the sales department or the market research group has indicated there will be a market. The question now arises as to whether this new product is worthy of further development, and what course should be established for that development. At this stage it is almost axiomatic that there will be virtually no process information available, that knowledge of the manufacturing technique involved is extremely sketchy, and that the investment required to install manufacturing facilities is completely unknown.

The First Step—The first step to be taken at this point should be to establish some idea of the sales value and potential sales volume of the new product. Such information can usually best be estimated by the sales department or the market research group and will depend upon the market volume and price for competitive products and alternately upon the utility value of the material to the customer. At this stage, it will probably be necessary to consider a range of sales prices for the material, starting with a relatively high price if the product serves a non-competitive use and ranging down to the price which might ultimately be reached through large scale production and/or competition. It is to be expected that an economically attractive product will bring other producers or other materials into competition.

Having established a sales price or at least a range of sales prices, it now becomes necessary to estimate the sales expenses which will be involved in marketing the material. These expenses may be high or low depending on the nature of the material. A product which should be sold in high volume and which will serve in the heavy chemicals field will probably require relatively low sales expenses. On the other hand, a specialty product or one which will invade a highly competitive field may necessitate high and continuing customer technical service expenditures. It will also be necessary at this stage to predict what continuing research expenditures may be necessary for the entrepreneur to maintain a sound competitive position in the field he is entering. The estimates of sales and research expenditure need not be defined in great detail but even at this early stage of development, they should be taken into consideration and given proper weight.

With a sales price and supporting expenses established, we now have an estimate of the money available to cover manufacturing costs, handling costs and return on capital. Even with only the sketchiest idea of what the manufacturing process will be, it is wise at this point to estimate manufacturing costs, taking into consideration all of the items appearing in Figure 3. It is true that perhaps none of these items can be defined with extreme accuracy. On the other hand, it is equally true that estimating each of the items individually will minimize the possibility of serious errors in estimating the total.

Raw Material Consumption—Generally speaking, with virtually no process information available at this stage, the most important variable to be taken into account is raw material consumption. It is at this stage that the economic evaluation serves as a guide to the research laboratory in establishing the yield levels which must be obtained to assure that a new product or a new process may be economically attractive.

It is also at this stage that an evaluation, preliminary though it may be, may serve to guide research and experimental effort into the most promising channels. There is, however, a warning to be sounded in that the economic evaluation, no matter how detailed, can never serve as a substitute for experimental effort. It can only point out which areas of a development should receive first attention in order to establish the economic utility of a new idea or a new process.

If sufficient process information is available to establish the range of material consumptions, the economic evaluation can serve as a guide to the development and design engineers by pointing out the extent of investment which can be made in entering the production of a new material. With such a guide, it may be possible for the development and design group to determine qualitatively whether or not the capital limitation can be met, or it may serve to indicate which process alternative must be developed.

In all of the foregoing considerations, of course, the element of production volume must be taken into account. It would be extremely unusual if at this stage a sales or market research group would commit themselves to any single level of sales and in actual fact, the history of the product will probably be one of increasing volume with time. The economic evaluation at this point can serve to outline the minimum sales levels at which the product can be marketed to financial advantage.

The economic evaluation as a guide for Management judgment on capital expenditures. Let us assume that the new product which we considered earlier has been successfully developed, that a process has been established, and that the investment requirements have been determined. At this point, all of the cost elements outlined in Figure 2 (namely, manufacturing costs, packaging, supporting research, capital requirements and costs, and

sales expenses) must all be combined and the monetary return to be expected must be presented to Management for their consideration. At this point, a detailed analysis of the anticipated manufacturing costs as outlined in Figure 3 is essential. In general, it may be said that virtually all items appearing in Figure 3 can be evaluated with considerable accuracy with the exception of maintenance labor and materials. These two items normally constitute the greatest area of uncertainty in the evaluation of new products and every effort must be made to relate the maintenance requirements of a new process with the maintenance costs of a similar operation. At this stage, packaging, handling, and warehousing costs may become of considerable importance and detailed attention should be given towards predicting what such costs will be.

From the sales price and the total cost of sales as determined from the items listed in Figure 2, we arrive at a gross profit. Certainly in this day of high income taxes, due allowance for such taxes must be taken into consideration. The residue or net profit must then be related by one criterion or another to the capital requirement of the project. This capital requirement should include both the fixed investment necessary to enter into production plus the working capital necessary to warehouse raw materials and finished product, and to merchandise the product once it is made.

A number of criteria are available for measuring the economic attractiveness of a project. One criterion, for example, is the payout period which is the length of time required for the entrepreneur to recover his fixed capital. In the calculation of payout period, net profit after taxes plus depreciation funds are considered as available for capital return. Another criterion, commonly used, is the net profit as a percentage of either fixed or total capital. The choice of criterion is relatively unimportant as long as we are consistent in our use of the criterion and as long as all concerned understand its significance.

Present Breakeven Level—In presenting the economics of a proposed project for management's consideration, it is important to avoid limiting consideration to only the most optimistic or even the most probable combination of sales volume and sales prices. It is wise to present, as well, the economic effect of reduced volume and price of the product. One device which is useful for presentation purposes is the breakeven level, i.e., that combination of sales volume and sales price at which the cost of sales equals sales revenue.

The economic evaluation as a guide in the establishment of pricing policies. The foregoing discussion relative to the use of economic evaluations for Management's decisions regarding capital investments can be applied to the use of evaluations as a guide to pricing policies.

Estimates of utility value of the product and possible costs of competitors (having either the same or a substitute product for sale) are frequently of value to Management in judging competitive position and longevity of its product in a competitive market.

Economic Evaluation as a Guide to Operating Management—Once a product or a process has been established, there is a continuing need for a close scrutiny of all cost elements which enter into the cost of sale of a product. A continuing review of actual cost versus original estimates or versus original estimates revised in accordance with experience can serve a very useful purpose to Operating Management on specific items of manufacturing costs. It can serve in addition the further purpose of pointing out to research and development those areas of the existing process which offer the greatest potential for improvement and cost reduction.

Figure 3. Manufacturing Costs

Raw Materials	———
Factory:	
Operating Labor	———
Operating Supplies	———
Repair Labor	———
Repair Materials	———
Supervision	———
Laboratory	———
Utilities	———
Insurance	———
Taxes (Ad Valorem)	———
Overhead	———
Depreciation	———
Total	———

Refining Economics—Finding Important Dollar Values

Continued from Page 106

the problem which in reality represents as complete a statement as possible of exactly what the problem is. The next step is the establishment of a material balance which represents the net effect on finished or unfinished refinery products and charge stocks for the problem involved. Product values and raw stock costs are assigned to the items in this material balance and operating costs, either total, controllable, or marginal, are included to arrive at the economic answer required. The economic answer may appear in the form of feed stock value, product cost, or economic credit. Economic analysis serves an important function in establishing raw stock values, costs of products, economic balances for optimum operation of existing equipment, justification of new equipment, and evaluation of research projects.

Cost Estimating

TABLE 1. Typical Estimating Form

	Material	Labor
1. Heaters		
2. Vessels		
3. Pumps and Compressors		
4. Tubulars		
5. Piping		
6. Structural		
7. Special Equipment		
8. Foundations and Earthwork		
9. Instruments		
10. Electrical		
11. Insulation and Fireproofing		
12. Buildings		
13. Painting		
Sub-Totals		

Definitive Cost Estimating

Accurate estimates combine art and science, knowledge and judgment. Follow this important checklist.

Harold Bottomley,
Petroleum Process Consultant,
Tulsa

MANY ARTICLES written on the subject of cost estimating are of necessity filled with generalities and lack concrete data which can be formed into valid equations, curves and tables. This discussion claims to be no exception. Good estimating is more of an art than an exact science but should be performed by persons with engineering knowledge of the field in which they are estimating.

As stressed by previous writers certain basic data must be available to the estimator before any sort of estimate can be prepared on a process unit, power plant or other industrial installation. Generally estimates fall into one of two major classes, "close" or detailed estimates and "horseback" or curve estimates. For a close estimate the process scheme must be fixed, a heat and material balance prepared, all equipment sized as to duty and capacity and in general a great amount of preliminary engineering work completed before the estimate can possess significance. Curve estimates are largely for sales or talking purposes and in reality should not be considered as true estimates.

The author, having spent a number of years in the petroleum process construction field, is well aware of the difficulties one can get into from these estimates. If the talking figure is too low by any appreciable amount a great loss of face, and possibly the contract, is not unlikely. The same reasoning also may apply should the rough estimate be very much on the high side. Curve estimates should be used with extreme caution and then only if the potential customer can be made to realize fully your position in furnishing such an estimate. It is the author's opinion that most conscientious engineers and contractors prefer not to furnish such estimates but are often often forced to do so for reasons beyond their control. Most "good" horseback estimates come from cost data that has been accumulated from actual jobs; but from experience, one knows that scarcely any two jobs are identical or cost the same when the accounts are all totalled.

During the balance of this discussion only the close estimate will be considered. As stated previously, it is necessary that the estimator have basic data at hand before attempting to set up the estimating forms. Should this data be lacking in any major aspect it will place an undue burden on the estimator in that he may have to improvise the engineering as he proceeds. This he should not be expected to do.

Set Procedure Advised—Every company doing estimating should have a set procedure for assembling the estimate, usually on printed or mimeographed sheets prepared in advance. It has been the author's practice to arrange the equipment in a more or less arbitrary series, as shown in Table 1.

In Items 1 to 4 inclusive and Item 7, there will usually be more than one piece of equipment under each heading. Therefore the units under each heading should be given identifying letters and numbers that can later be transferred to the flow sheet and specification sheets to aid in identification on requisitions, purchase orders and while receiving and place of the equipment during construction.

A customer deeply appreciates a detailed and well developed estimate form, i.e., one in which each item of major equipment is described completely as to performance data and physical composition. For instance, it is not adequate to describe a pump as "1-P-1 Motor Driven Centrifugal." It should be more completely described as,

1-P-1 Main Column Reflux Pump
One single stage, vertically split, process type centrifugal pump with cast iron case trimmed for normal corrosion protection capacity 250 gpm at 50 ess type centrifugal pump with cast 1 group D, 15-hp explosion proof motor driver.

It is felt that the information given above is adequate for the estimate write-up. More detailed data on the pump and driver can be included on the specification sheets attached to the estimate or from the quotations furnished by the equipment suppliers.

Economics

Other sections of the estimate covering piping, structural, foundations, etc., should be described in the write-up portion of the estimate in a general way giving the salient features of the section but omitting details which can be covered by general specifications included with the estimate and proposal. An estimate well filled with pertinent information goes a long way toward influencing a potential customer that the contractor knows whereof he speaks.

The author has been requested to dwell mainly on equipment estimating forsaking the over-all process unit estimate for a companion article. At first blush it seemed that such a discussion would be easy to prepare and could possibly contain information of considerable value. However, since spending a great amount of thought on the subject it appears that in its simplicity it may not furnish the information desired. Since the purpose of this symposium and article is to furnish data on how the other person derives a close estimate the following is offered for consideration and discussion.

Heaters—Taking the items in order. Heaters, after designs are frozen may be priced from a bill of materials furnished by the engineering department listing the various quantities of refractories, structural steel, castings, tubes, headers and miscellaneous material by obtaining quotations from suppliers of this equipment. Erection labor must be developed from a man hour-time study or from data derived from actual field erection of like size heaters. The author possesses data necessary for estimating a certain type of high efficiency heater in sizes ranging from 5 to 60 million Btu per hour absorption rates, however, it is felt that the introduction of this data here would be out of place due to the multitude of details involved and the time required for presentation. Major contractors usually possess their own heater designs and have the data necessary for assembling a close estimate on any size desired.

Often heater prices are derived from firm quotations obtained from heater manufacturers. In case this procedure is followed it is necessary to supply the vendor with all the thruput capacity data, design and material specifications desired in the bid. The author has found that it is safer to follow the second course above in preparing a close estimate if the customer will accept a heater such as those offered by the vendors.

Vessels—Vessels, the second category on the equipment list usually comprise a considerable portion of the estimate and here likewise there are two possible routes for arriving at a cost. The easier, and likely the most accurate, is to obtain quotations from several vendors and arrive at an average price to place in the estimate. The other is to calculate weights and apply per-pound prices to the various vessels and drums of differing complexity. Usually, arriving at vessel prices in the latter manner is merely making an educated guess for normally the estimator is not a vessel expert nor does he have all the datavat hand to compensate for complexity, plate thickness, welding techniques, nozzle and manway installation, waste allowance, most economical sheet size, etc. Several published estimating handbooks contain data purporting to aid in arriving at vessel prices; however, the author has found that assembling an estimate from an average of several vendors' quotations is far superior to attempting to estimate from vessel weights and unit prices per pound.

To the quoted vessel prices must be added the vessel internals, if required. Accurate and firm quotations on bubble trays, side to side pans and chimney trays may be obtained from a number of sources and should be used in lieu of a weight or cost per square foot basis.

It will be found from time to time that considerable variation will be noted in various vendors' vessel quotations. These variations are probably largely due to plant location, labor rates, tonnage handled, shop facilities and capacity, need for the work and differing profit margins. Considerable judgment must be exercised in the selection of the vessel prices to be included in the estimate. At the present time bids from prime contractors are mainly on a turnkey or ceiling basis and for this reason vendors should be urged to firm up all prices submitted to the contractor. Estimators usually have data from previous jobs from which per pound prices of vessels and drums can be secured as a rough check on the reasonableness of the quotations.

The cost of field labor for the installation of the vessels, drums and internals should be arrived at by carefully studying the job and including therefor all necessary costs such as direct supervision and labor, crane or rigging equipment rentals, dead men, guying, tray installation and leveling and final testing. Sufficient weight should be given the number of vessels to be set, their proximity to one another and the specific erection equipment that can be utilized without duplication of costs.

Pumps, Tubulars, Etc.—Since it has been assumed that for a close estimate the estimator has been furnished with complete equipment lists and specifications covering all pumps, drivers, tubulars, compressors, etc., it will only be necessary that he send the specification sheets to the respective vendors for accurate quotations on them. To attempt to estimate their costs himself is a sheer waste of time and is of questionable accuracy at best. The estimator's time can be better spent developing the labor costs involved in setting this equipment once weights and physical dimensions are available. Checking the process flowsheets for completeness of equipment listings is another important task of the careful estimator.

As can be easily realized, "estimating" or pricing from vendors' quotations Items 1 to 4 can be a relatively simple operation which is subject to extreme accuracy. From a check of a great number of estimates versus actual equipment costs it appears that the accuracy should be in the order of plus or minus three percent providing no appreciable changes in design or job scope are made following the preparation of the estimate.

Piping—Items from 5 to 13 inclusive (excepting Item 7) present a much more complex problem in attempting to estimate them accurately. Piping may be estimated by actually pricing all the pipe, valves, fittings, bolts and gaskets but most estimators prefer to depend on previously completed jobs on units of similar construction, applying a factor to correct for price increases or declines. In order for the latter method to be effective cost accounting data must be accurate and allocations of piping materials to each individual unit correct.

Another method, widely used, is the application of a percentage to the cost of the major items of equipment to determine the piping materials cost. Naturally this percentage will vary somewhat with different type units but should prove to be a more accurate method than a piping take-off unless the piping drawings are complete and all bills of materials accurately prepared. Even though a piping estimate is prepared from a take-off an adequate contingency should be added to cover omissions.

In order to firm up piping estimates, both as to material and labor,

very accurate cost accounting records should be kept. Should the piping be purchased in bulk for an entire job an accurate account of the piping materials and labor entering each unit must be maintained if the costs are to have any value in preparing future estimates. It is rather discouraging to check job after job and find that faulty allocations of materials and labor have practically erased the value of the cost record keeping.

Structural Steel—Estimating the structural steel required on a job should be by the "take-off" method applying an average cost per pound to the total estimated weight. Should there be a disproportionate amount of either light or heavy structural the cost per pound must be weighted to allow for this situation. Structural steel fabricators are helpful in preparing estimates and usually have well defined prices for structural of the various classes such as ladders, cages, platforms, heater steel, casing plate and grating. Occasionally considerable spread will be found in vendors' quotations on structural steel. These variations can usually be attributed to the same factors affecting quotations as was brought out under vessels above. In a complete job estimate the structural cost is only a small percentage of the job and some error in its estimation will have little effect on the prime estimate.

Foundations and Earthwork—Foundations and earthwork, though not items of equipment, deserve considerable attention. The job site must be inspected and determinations made as to the types of foundations required and the load bearing characteristics of the soil. The omission of piling in an estimate can cause an error of 25 percent or more in the total foundation cost. Most estimators have unit prices set up for the various types of foundations. Thus it is only necessary for the estimator to perform relatively simple, though tedious, arithmetical calculations to arrive at the total foundation estimate. Some adjustment in the unit prices may be necessary from job to job due to differing conditions.

Instruments—Estimating the instrument category is a relatively simple operation involving the pricing of a complete list of instruments derived from a detailed process flow sheet of the unit being estimated. Usually included under this category are all temperature, pressure, flow and level indicators, recorders and controllers, control and slide valves, pressure gauges and steam traps along with the tubing, fittings and necessary instrument auxiliaries. The latter includes mercury, filter sets, manifolds, charts and orifice flanges. Since the advent of the graphic panel in process design the instrument manufacturer can quote the complete control panel, factory assembled, piped and wired. Purchasing the panel thus reduces the field work appreciably and enables the estimator to eliminate a possible source of error in his instrumentation estimate.

TABLE 2
Breakdown of Material Costs for FCCU

	Percentage of Total Materials
Heaters (air)	.8
Vessels	24.0
Pumps and blower	17.8
Tubulars	7.2
Piping (shop fabricated over 2")	22.6
Structural (shop fabricated)	4.6
Special equipment	1.7
Foundations and earthwork	3.5
Instruments	6.8
Electrical	3.4
Insulation and fireproofing (sub-contract)	6.2
Buildings	1.3
Painting	.1

Electrical—The preparation of an electrical estimate is a tedious and wholly unnecessary chore for the prime estimator as this portion of a construction contract is almost always sub-contracted. Firm bids can be obtained from electrical contractors if they can be apprised of the scope of the work. Several bids should be secured and an average figure entered in the prime estimate. Knowledge of an electrical contractor's past performances is helpful in selecting the price to be used.

Insulation—Insulation and fireproofing are likewise items that are usually sub-contracted. The submission of complete piping and vessel drawings to the insulation contractor will usually result in a firm or ceiling bid. However, should the estimator desire to compound the insulation estimate himself it is not too difficult to do so. By making a close estimate of the piping footage and fittings and applying unit prices, which are readily available, and adding thereto the vessel, exchanger and pump insulation which can also be calculated by means of unit prices the estimator can arrive at a close figure for the insulation cost. If the work is to be sub-contracted adequate sub-contractor's overhead and profit should also be included in the price used in the prime estimate.

Buildings—Should there be buildings involved in the job the estimator may either enter a price based on unit prices per square foot or floor area or he may build up the estimate item by item. Both methods have proven satisfactory and since the buildings cost is such a small percentage of the over-all job cost a slight error here will have little significance in the total estimate.

Painting—Painting is likewise a relatively minor item in the total estimate, painting materials usually consisting of only .1 to .2 percent of the total materials. Many times painting is also sub-contracted to specialists in this field and a firm quotation can be used in lieu of an estimate.

Summary and Conclusions

From all the foregoing it may appear that the author has placed the burden of preparing equipment estimates on the shoulders of other than the prime estimator. This is largely true except for certain categories such as piping and concrete work. This is as it should be since it makes for a much more accurate estimate and one that can be readily utilized in a prime proposal. Past experience has upheld this opinion and it is felt, though not definitely known, that the majority of close estimators use this method.

Once a prime estimate has been prepared it is necessary that it be studied minutely, the percentages of the various categories based on total materials determined and then compared with former job costs to ascertain the reasonableness of the estimate.

In examining an estimate great care should be used. No two jobs are exactly alike and due weight must be given to differences in units which are ostensibly duplicates. Investigation of the material costs of five fluid catalytic cracking units costing from $1,300,000 to $1,800,000 each has developed the percentage breakdown on materials shown in Table 2.

Naturally the material distribution will not necessarily hold for dissimilar units. Each type of unit must be analyzed in order to provide guiding data for future estimates.

Even on a close estimate an estimating contingency should be applied, the amount to be determined by the time and care spent in preparing the estimate. This contingency should seldom exceed 3-5 percent unless there is reason to believe that some change in job scope is contemplated.

Compare these four methods for . . .

Making Phthalic Anhydride

1. Conventional catalysts in a fixed catalyst bed

2. German catalyst in a fixed catalyst bed

3. Fluidized bed of conventional catalysts

4. Fluidized bed of the German catalyst

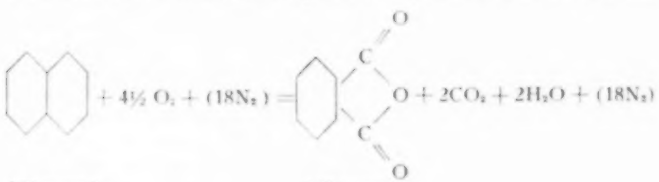
Robert F. Ruthruff, Consulting Chemist and Chemical Engineer, Homewood, Ill.

AT PRESENT, phthalic anhydride is obtained principally by the vapor phase catalytic oxidation of naphthalene with air. A small amount of phthalic anhydride is made by similarly oxidizing o-xylene. Four major points covered are

- Catalysts used
- Fluidized and fixed bed operation
- Efficiency
- Product purity

Four combinations of operating techniques and catalysts may be employed in the preparation of phthalic anhydride. These are (1) conventional catalysts in a fixed catalyst bed, (2) the German catalyst in a fixed catalyst bed, (3) fluidized bed of conventional catalysts and (4) fluidized bed of the German catalyst. The principal operating conditions and yields with these four methods of operation are summarized in Table 1.

The air oxidation of naphthalene to phthalic anhydride proceeds in accordance with the theoretical equation:



128 pounds (100 pounds) — 148 pounds (126 pounds)

Phthalic anhydride yields are normally expressed, not in percent of theory, but rather as pounds of phthalic anhydride produced per hundred pounds of feed charged. On this basis, the maximum possible yield from naphthalene is somewhat less than 126.

How Types of Catalyst Differ—The conventional catalyst consists of 10 percent vanadium pentoxide on an inert support. Alundum, granulated metallic aluminum, silica and pumice have been used as supports. The inert support must be as free as possible of alkali metal oxides. Alkali metal oxides, if present, gradually react with the catalytically active component resulting in a decline in activity. Active substrates, such as silica gel and activated alumina, produce catalysts of such high activity that complete oxidation of naphthalene to carbon dioxide and water is excessive.

Soon after the conclusion of the European phase of World War II it was found that the Germans had developed a catalyst for the production of phthalic anhydride markedly superior to catalysts used in the United States. As mentioned previously, conventional catalysts are prepared using an inert support as free as possible from alkali metal oxides. The German catalyst violates both of these principles, being vanadium pentoxide on silica gel containing large proportions of potassium sulfate. The composition is in the range of 10 percent vanadium pentoxide, 20-30 percent potassium sulfate and 70-60 percent silica gel. Apparently, the alkali metal salt poisons the silica gel to the extent necessary to give a support which, when combined with vanadium pentoxide, results in a catalyst far superior to conventional vanadium pentoxide-inert support catalysts.

TABLE 1
Phthalic Anhydride Operating Conditions and Yields

Type of Operation	Fixed Bed		Fluidized	
Catalyst	Conventional	German	Conventional	German
Temperature, °F.	750-885	645-705	680	700
Pressure, lbs.	25	7.5	15	15
Contact time, sec.*	0.6	4.2	19	19
Lbs. air/lb. $C_{10}H_8$	25-30	30	15	15
Lbs. chg./hr./sq. ft. reactor cross section	39	15	18	18
Lbs. chg./hr./cu. ft. reactor volume	20	2	1	1
Lbs. catalyst/lb. charge/hr.	5.9	13.4	37.5	37.5
Yield, crude PA	80	104	80	100

* Volume occupied by catalyst neglected.

Required Air Ratios—Returning to a consideration of the previous equation, since air is used as the oxidizing agent, 18 moles nitrogen are included on both sides, equivalent to 22.5 volumes air per volume naphthalene vapor or 5.1 pounds air per pound of naphthalene. Actually, a large excess of air is employed for a variety of reasons. In the first place, appreciable maleic anhydride is usually produced and even more naphthalene is completely oxidized to carbon dioxide and water. In addition, excess air is necessary for rapid reaction at reasonable temperatures and to insure the production of phthalic anhydride uncontaminated with the unconverted charge of reaction products. Also, in fixed catalyst bed operations, a large excess of air is employed to produce a charge outside the explosive limits on the lean side. While some fixed bed units are operated charging a reaction mixture within the explosive limits, it is more general practice, as indicated in Table 1, to use around 25-30 pounds air per pound naphthalene—five to six times theory.

In operations employing a catalyst in fluidized form, due to the intimacy of the mixture of fluidized, finely divided catalyst particles and the charge and the high concentration of catalyst particles in the charge, the actual reaction volume is composed of myriads of interstitial spaces of non-explosive dimensions and accordingly explosion chains will not be propagated and a reaction mixture within the explosive range will not explode. For these reasons, instead of using 25-30 pounds air

per pound of naphthalene, as is highly advisable in fixed bed operations, half this quantity of air or even less can be safely employed in the fluidized catalyst process as is indicated in Table 1. This obviously results in considerable savings in the construction cost of a fluidized catalyst unit of a given productive capacity in that smaller compressors, vessels, piping, valves, etcetera are employed. Also, operating costs are appreciably lower since only half as much air need be compressed to produce a given quantity of phthalic anhydride.

Reaction Conditions—As Table 1 shows, the operating conditions employed in fixed bed units using the German catalyst differ materially from those of fixed bed units employing conventional catalysts. With the German catalyst, an extremely long contact time of 4.2 seconds is required in comparison to only 0.6 seconds with conventional catalysts. About 0.5 cubic feet of catalyst space is provided per pound per hour of naphthalene charged to units containing German catalyst, a volume ten times that provided in fixed bed units charged with conventional catalysts. These wide differences preclude the direct substitution of German catalyst in existing fixed bed units designed for use with conventional catalysts.

Peculiarly, as Table 1 shows, the German catalyst may be substituted for conventional catalyst in fluidized catalyst units with no material changes in operating conditions. Use of the German catalyst results in materially enhanced yields of phthalic anhydride.

The reaction conditions employed with a fluidized catalyst differ materially from those used in fixed bed units. A reaction temperature of 690 F. is used with the fluidized catalyst versus 750-885 F. in fixed bed units with conventional catalysts or 645-705 F. in fixed bed units employing the German catalyst. The contact time in the fluidized bed is about 20 seconds, some 30-40 times that in fixed bed units employing the conventional catalyst or 4.5 times the already long contact time employed in fixed bed units with the German catalyst. In fluidized catalyst operations, the catalyst inventory (pounds catalyst per pound per hour of charge) is much higher (almost six fold greater) than in fixed bed conventional catalyst units and almost three fold greater than in fixed bed German catalyst units.

Table 1 shows that for a given charging capacity, the reaction volume required in units employing the fluidized catalyst technique is 20 times that of a fixed bed conventional catalyst unit and twice that of a fixed bed unit charged with German catalyst. However, it should be noted that the reaction volume in fixed bed units is very complicated and very expensive to construct.

Temperature Control—Some 6300 Btu are evolved per pound of solid naphthalene converted to phthalic anhydride. Due to incidental production of compounds at a higher state of oxidation, heat evolution is even greater than this theoretical value, being in the neighborhood of 7300 Btu per pound of solid charge at a yield of 100 and 9750 Btu per pound of solid charge at a yield of 30, assuming that all naphthalene not converted to phthalic anhydride is completely burned to carbon dioxide and water. The necessity for dissipating this high heat of reaction imposes severe restrictions on the design of a satisfactory fixed bed reactor. Obviously, a large heat transfer surface is required per unit volume of reaction space and all parts of the reaction space must be as close as possible to the heat transfer surface. Accordingly, fixed bed reactors take the form of myriads of small tubes surrounded by a suitable medium for the removal of heat. Since the rate of heat transfer is low, many small tubes, giving a large surface per unit volume of catalyst space must be employed to achieve even a semblance of temperature control.

In fluidized catalyst units, the reactor consists of an elongated cylindrical vessel having a volume appropriate for the productive capacity desired. Extremely accurate control of the reaction temperature in the fluidized catalyst bed is easily achieved by conventional procedures. Catalyst is withdrawn from the reaction zone through a valved line, the degree of opening of the valve being controlled automatically and responsive to the temperature within the reaction zone. Withdrawn catalyst passes to the bottom of a tubular cooler and the catalyst particles are blown (with reaction air) upward at high velocity through the tubes thereof and back to the fluidized bed. The tubes are surrounded by water under pressure and the abstracted heat is recovered as high pressure steam.

A high rate of heat transfer is achieved and, as a result, even though a relatively small cooler is employed, perfect temperature control results.

Introduction of Charge. Liquid naphthalene is added directly to the fluidized catalyst reaction zone. In fixed bed units, to avoid the possibility of explosions and to insure distribution of a uniform charge to each of the large number of catalyst tubes, the naphthalene is vaporized (in the presence of air) prior to passing to reactor.

Placing Catalyst in Reactor. In fluidized units, the required quantity of finely divided catalyst is simply added to the reactor by any convenient method. In fixed bed units, the catalyst particles are placed in myriads of tiny tubes. Considerable care must be exercised in packing these tubes with catalyst to insure that the pressure drop through all tubes is the same under operating conditions.

Separation of Catalyst from Product Gases. Since large catalyst particles are employed in fixed bed operations, the problem of separating product from catalyst does not arise. In fluidized units, on the other hand, because of the small particle size of the catalyst, some catalyst becomes suspended in the product gases and must be removed therefrom by filtration. Accordingly, fluidized catalyst units require a filtering system not required in fixed bed units.

Product Recovery. Regardless of method of operation, recovery of phthalic anhydride from product gases usually involves first, precooling the gases to a temperature somewhat above the phthalic anhydride dew point of the mixture and second, further cooling the gases in the product recovery system proper to a temperature somewhat above the water dew point of the mixture. Due to the low air/naphthalene ratios employed in fluidized catalyst operations, the heat content of the product gases per unit weight of phthalic anhydride is only slightly more than half as great as that of reaction mixtures from fixed bed operations. As a result, for a given productive capacity, smaller recovery systems may be employed with fluidized catalyst units and recovery methods, not feasible for use in connection with fixed bed units due to high heat loads involved, may be successfully employed.

Product Purity. Phthalic anhydride from fluidized catalyst operations analyzes 97-99 percent pure. Only traces of maleic anhydride can be detected in contrast to products from fixed bed operations with a conventional vanadium pentoxide-inert support catalyst where maleic anhydride is frequently produced in appreciable amounts. In fixed bed units designed to use the German catalyst, the product purity is the same as that observed in fluidized catalyst operations. However, the crude product from any type of operation must be vacuum distilled to give a marketable material but obviously, the higher the initial purity of the still charge, the higher the recovery of marketable product on vacuum distillation.

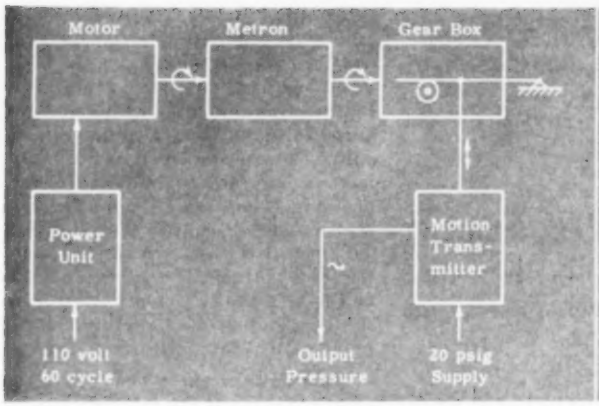


Figure 3. Pneumatic sine wave generator

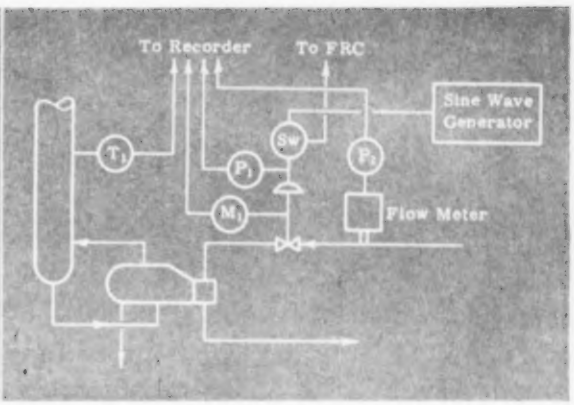


Figure 4. Frequency response test setup

Analyzing Process Control Systems

A new technique for applying sound engineering fundamentals to the study of process control has these objectives:

- **Increased speed of response to set point changes**
- **Improved stability and continuity of operations**

P. R. Hoyt and B. D. Stanton,
Shell Development Company,
Emeryville, Calif.

THIS ARTICLE remedies a deficiency in the technical literature on how to analyze process control systems. Graphical and mathematical analysis methods, based on field test data, were used to predict and improve the control of an extractive distillation unit. The test methods and analysis of results are described in sufficient detail to permit application by the reader to problems at his particular plant.

Introduction—Process control engineers are becoming familiar with frequency response methods for analyzing control system. Extensive investigations and theoretical studies utilizing these methods have contributed much to our understanding of automatic control problems in the process industries. Further progress in this field is now dependent on practical experience and the availability or reliable data.

Realizing this, many organizations and companies, including the one with which the authors are associated, are now actively engaged in programs for determining the characteristics of control system components and process equipment. The method used is one of mathematical analysis supplemented by experimental data based on frequency response tests. Considerable progress has been made in the case of controllers, measuring instruments, and other control system components. Dynamic characteristics of conventional types of controller actions and their relationships have been determined and expressed in terms of frequency response.[1,2] Information is also available on testing methods and equipment now being used for sinusoid and step input disturbance tests.[3] Recent developments of control system components with improved dynamic characteristics are evidence of the progress in this field.

In the case of processes and associated equipment one can well appreciate that the problems involved in testing are somewhat more complex. Two lines of approach are being followed:

(1) Determination of the basic characteristics of various types of full scale process equipment. Here extensive tests can be planned and complete studies made over wide ranges of operating conditions, since the only limitations are the test facilities.

(2) Determination of the operating characteristics of complete systems, including the process and the associ-

Originally presented as "Process Control System Analysis Based on Field Test Data" at symposium on Instrumentation for the Process Industries, Texas A. & M. College, January, 1953.

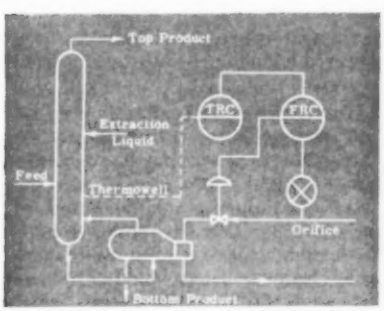


Figure 1. Schematic diagram of process and control system

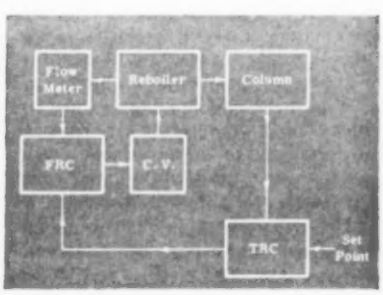


Figure 2. Block diagram of the process control system

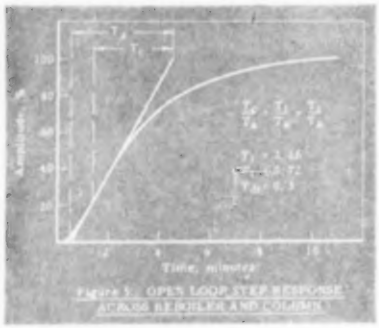


Figure 5. Open loop step response across reboiler and column

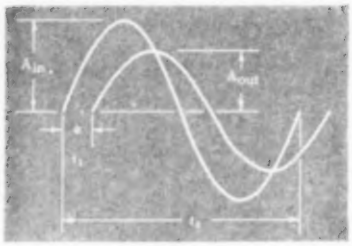


Figure 6. Schematic of test data. Amplitude ratio (AR) $= \frac{A_{out}}{A_{in}}$; Decibels (db) $= 20 \log_{10}$ AR; Phase shift (Φ) $= \frac{360 \times T_1}{t_2}$

ated control system elements, which are integral parts of an operating plant. The data obtained under these conditions are comparatively limited, since the tests must be made without causing serious plant upsets resulting in deviation from product specifications. Testing operating systems provides data for improving the existing control system, and can be used in future design of such units.

This discussion is concerned with the testing of a process under normal operating conditions. Field tests of a temperature control system on an extractive distillation column are described. Test equipment, methods of introducing input disturbances and recording output responses, and some of the practical aspects of making the tests are discussed. Based on the test data, the response characteristics of the process and the control system components are determined, and the numerical values of their parameters are derived. It is shown that with this information alterations or re-arrangement of components can be made which are both economical and practical, and the over-all control improvements can be predicted.

From an economic and operating viewpoint the primary interest in the study of this system was to determine if the speed of response and stability could be improved following a set point change. Due to operating schedules it is necessary to change feed stock and product specifications frequently, which necessitates making radical changes in the set point of the temperature controller. Significant savings can be realized by increasing the response rate and restoring equilibrium in a minimum of time following changes of operating conditions. Long range benefits of equal importance include (1) field experience in test methods and the use of suitable test equipment, (2) determination of the usefulness of test data which can be obtained with input disturbances held within the limits required to prevent plant upsets, and (3) advancement of our understanding and knowledge of process control systems.

System Tested—A schematic layout of the column and control system that was tested is shown in Figure 1. This is a narrow-cut fractionating column having 65 trays. The feed, which is on flow control, enters the column on the 19th tray while the extraction solvent, also on flow control, is introduced on the 38th tray. Heat is supplied to the column through a kettle-type reboiler using hot oil as a heat medium. The flow of products and solvent leaving the bottom of the column is controlled by a level controller on the reboiler. The reflux is on flow control and the top product is controlled by a level controller on the tops accumulator. Pressure is controlled by bleeding gas into the tops accumulator. The column operates at atmospheric pressure or slightly above. Since the desired product emerges from the bottom, the temperature control sensing element is located in the lower part of the column. Experience had indicated the 14th tray as the optimum location, and on this tray the temperature must be held within $\pm\frac{1}{4}$ F.

The temperature control system is of the cascade type as shown by the block diagram in Figure 2. The temperature sensing element is a resistance thermometer which is connected to a 50 F. span electronic temperature recorder. A mechanical-pneumatic controller with proportional and reset functions is connected to the recorder. The pneumatic output signal from the controller adjusts the set point of a flow recorder controller, which controls the heat medium flow to the reboiler. This FRC receives a pneumatic flow signal from a 0-100 inches mercury manometer-type differential pressure transmitter. Flow is converted to differential pressure by means of an orifice and flange type pressure connections. The output of the FRC is connected to a valve positioner on the control valve. The control valve is a conventional diaphragm-spring motor valve with a six-inch body and an equal percentage-type inner valve. The TRC and the FRC are located on the main panel board in the control room while the flow transmitter is locally mounted adjacent to the heat medium control valve. The size and length of the transmission lines are as follows: 100 feet of $\frac{1}{4}$ inch o.d. tubing from the flow transmitter to the record controller; 115 feet of $\frac{3}{8}$ inch o.d. tubing from the flow controller to the control valve; 10 feet of $\frac{3}{8}$ inch tubing from the temperature controller to the set point of the flow recorder controller.

Test Equipment—The test equipment consisted of the following major components: (1) pick-ups or sensing elements, (2) amplifiers and recorder, (3) a function generator, and (4) communication equipment. The complete system was electrical and offered the advantages of high amplification, fast speed of response, flexibility and ease of installation. The pick-ups were strain gage type pressure cells for measuring pressure, resistance thermometers for measuring temperature, and linear potentiometers for measuring motion. The recorder was a four-channel strip chart type, with chart speeds adjustable from $\frac{1}{4}$ mm per second to 100 mm per second. Carrier-type amplifiers were used with the bridge-type measuring circuits and a DC amplifier with the linear potentiometer. The maximum measuring sensitivity was of the order of 50 mm of pen travel per 1 F., $\frac{1}{4}$ psig, and $\frac{3}{16}$-inch linear motion. The function generator is shown schematically in Figure 3. It was designed to generate sine wave pneumatic signals over the frequency and amplitude ranges required for most process control systems. A variable speed motor rotates an eccentric cam through an adjustable speed changer transmission unit. Through a level system the cam operates a pneumatic motion transmitter, which in turn produces a pneumatic sine wave output signal with less than 2 percent distortion up to 4 cps. In the tests to be described frequencies from 1 cycle in 30 minutes to 1 cycle per second were used. The communication equipment consisted of four battery-powered telephone head sets connected in series.

Description of Tests—The field tests were confined primarily to obtaining the dynamic and static characteristics of the process. It was not necessary to make complete tests of the components in the control system, as the characteristics of similar equipment had been determined beforehand by laboratory tests. However, some field measurements were made to determine the actual value of the control

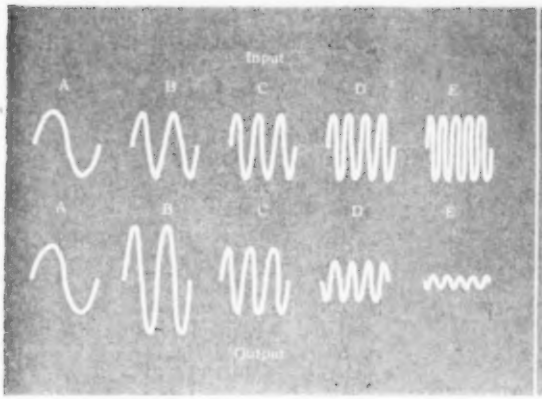


Figure 7. Frequency response data

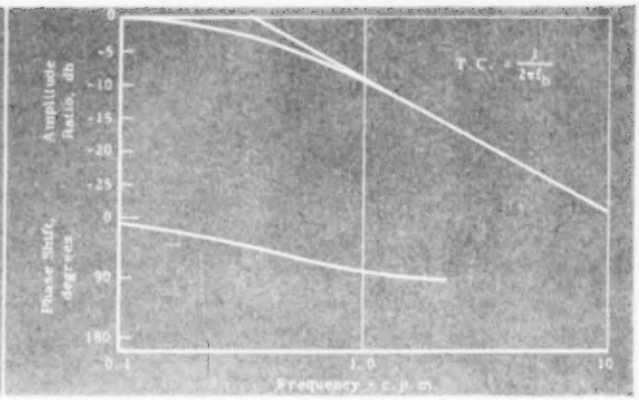


Figure 8. Open loop response of control valve-pipe-flow meter

function constants with the controllers affected by the loading of the control circuit. Step and variable frequency sine wave input disturbances were imparted to the system.

The test equipment was arranged and connected as shown in Figure 4. Both open loop and closed loop step response tests were made first. It is not within the scope of this paper to give a full explanation of the significance or methods of analyzing open and closed loop transient response curves.[4,5] Briefly, however, the open loop transient response furnishes information on the static relationship (i.e., gain factors, linearity, etc.) and on the approximate dynamic characteristics (i.e., number and value of major time constants, dead time, etc.) of elements in the control loop. Closed loop response curves are most useful as a means for observing and judging the performance of a complete control system (i.e., closed loop linearity, speed of response and damping ratio). By obtaining step response data first, the information can be used as a guide in making subsequent frequency response tests. By approximation methods[6] the time constants can be determined, to give an indication of the frequencies that would provide the most significant data.

It will be noted that the equipment was arranged to test the flow process and the temperature process simultaneously. The temperature process includes the heat medium control valve, the reboiler, the column, and the thermowell with the resistance thermometer. The flow process includes the heat medium control valve, the piping and the mercury manometer. Air pressure input to the control valve was measured at (P_1) with a pressure pick-up, and the resulting valve stem motion at (M_1) with a linear potentiometer. Flow changes were measured at (P_2) with a pressure pick-up connected to the output of the flow transmitter, and temperature changes at (T_1) with a resistance element in a thermowell located on the control tray. The recording system and the sine wave generator were located at ground level approximately 35 feet from the flow transmitter and control valve which were about 15 feet above ground. The three-way air switch SW, was mounted on top of the control valve.

Prior to starting the tests records were obtained of the four variables listed above for a period of several hours. These data had no direct value in analyzing the system, but they did provide a picture of typical load fluctuations which occur during normal operation. This also provided an opportunity to observe operation of the various components of the recording system and to determine the optimum sensitivity adjustments, chart, speeds, etc.

The closed loop step response tests were made by manually shifting the set point of the TRC above and below the control point, first in small increments in the order of 0.2 F. The magnitude of the steps was then increased to ±0.5 F., which was the maximum allowable. From the data recorded at P_1, P_2 and T_1 the amount of input pressure change to the diaphragm motor of the control valve required to produce 0.5 F. temperature change was determined. With this information available it was then possible to make open loop step response tests with little danger of upsetting the plant. First the FRC and the TRC were transferred to remote manual control in the control room. In order to approach a step type input pressure change to the valve, use was made of the reducing valve on the sine wave generator as the source for one pressure level, and the remote manual station of the FRC as the other. The input pressure was changed by turning of the three-way switch SW_1, Figure 4. To facilitate making this test, a man was required at each of three stations: the control board, the control valve where the three-way switch was loctaed, and the recording equipment and sine wave generator. Telephone communication was provided between the three members of the test group. With this arrangement the tests were made in a minimum of time and with little interference to plant operation.

The test set-up and the procedures followed in making the frequency response tests were very similar to those used in the open loop step response tests just described. The sine wave generator was first adjusted until its average value or "d.c." level was the same as the pressure on the diaphragm motor. The sine wave amplitude was adjusted to give temperature changes no greater than ½ F. above and below the control point. The input pressure to the diaphragm motor was then transferred from remote control at the panel to the output of the sine wave generator.

The test was started at the high end of the frequency range to be explored rather than the low end. There are good reasons for following this procedure, particularly when testing processes with comparatively long response times. It will be remembered from the description of the process that there are several closed loop control systems associated with the column. In addition there are other feed-back paths within the process. For example, the bottoms product exchanges heat with the feed to the column. The interaction effects from these systems tend to be more troublesome at the lower test frequencies. The disturbances of long periods are transmitted through the feed-back paths with little attenuation and are apt to distort the response records of the system under test and may upset other process control loops. Even though input disturbances are of small magnitude in terms of the system variable under test, the effect on

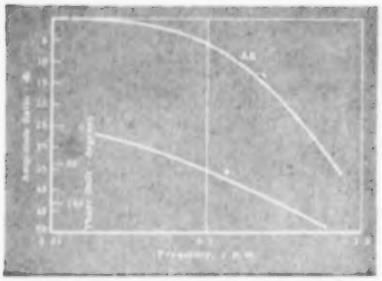


Figure 9. Open loop frequency response of column and reboiler

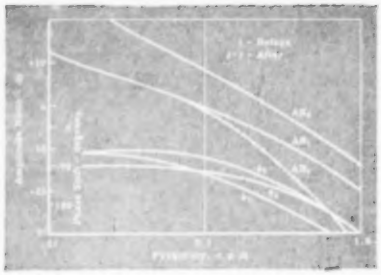


Figure 10. Open loop frequency response of temperature control system before and after changes

other process variables may be appreciable. For example, the temperature-pressure relationship of a product may be such that a small temperature change will result in a comparatively large pressure change.

Fortunately it is not too important if frequency response data cannot be obtained at the lower frequencies where the above effects may occur. It can be shown that the major time constants, which appear in the low frequency spectrum, can be determined within practical accuracies from step response curves. This will be explained in more detail in the discussion of test results to show the importance of obtaining step response data.

Another factor which may interfere with frequency response tests is drift. In this case the temperature could be affected by changes in composition of feed, heat medium, temperature or flow rate, etc.

The time required for making a complete frequency response test covering the desired range was approximately four hours. By close observation, and following the procedure just outlined, little trouble was experienced from drift or interference from extraneous sources. On the other hand the tests in no way interfered with normal operations of the plant.

As will be explained later, analysis of the data indicated that it might be desirable to relocate the sensing element of the temperature controller to a lower tray in the column. In order to find the optimum location, tests were made to determine the relative changes of temperature at equally spaced trays from the reboiler to the 14th tray in response to step changes in the flow rate of the heat medium. These open loop tests provided a dynamic temperature profile which proved more useful from a control standpoint than the conventional static profile curves.

Test Results—From analysis of the test data the numerical values of the system's parameters were determined. These are listed in Table 1. It may be of interest to consider briefly certain significant characteristics of the step and frequency response diagrams which determine the response characteristics of the processes.

An open loop step response curve of the temperature process is shown in Figure 5. It will be noted that for a short time there is no response to the input change. This represents the dead time. As time advances the temperature rises to its final value, forming an S-shaped curve. The first knee of the curve, where the slope changes relatively fast with time, is due to the short time constants (high frequency). The second knee of the curve, where the slope changes at a slower rate with time, is due to the large time constant (low frequency). It is interesting to note that the value of the major time constant T_1 (2.26 minutes) is the same as that determined from the frequency response data. From the step response data, the proportional gain (output divided by input) was determined for both the flow process and the temperature process. (See Table 1.)

The frequency response data appear in the form of input and output records as shown in Figure 7. Note that as the frequency increases, the amplitude of the output may rise before it decreases. Figure 6 illustrates the method for determining the amplitude ratio and the phase shift for each frequency from the input and output records. From these data two curves are plotted; frequency vs. amplitude ratio and frequency vs. phase shift. These are sometimes referred to as Bode diagrams.[7, 8, 9, 10]

The results of the frequency response tests of the flow process are shown in Figure 8. From the characteristics of the amplitude ratio curve and the associated phase shift, there appears to be a single time constant of 0.45 minute. The time constant of 0.45 minute was determined to be due to the damped mercury manometer of the flow transmitter. The lags of the transmission lines and the control valve are insignificant in comparison to that of the manometer and are not apparent at the test frequencies. The adjustments of the controller functions were 0.33 repeat per minute reset rate and 50 percent proportional band. (Gain of 2.0.)

Comparison of the time constants of the flow process (0.45 minute), and the temperature process (2.26 minutes) shows that the flow process responds much faster. However, since the flow control system is the slave of the temperature controller, its response time should be negligible compared to that of the temperature process. The mercury manometer was replaced, therefore, with a diaphragm-type differential pressure transmitter. As a further improvement, a high capacity type valve positioner was installed on the diaphragm control valve. Since the lags of the transmission lines were insignificant there was no justification for local mounting of the controller.

The frequency response curves of the temperature process are shown in Figure 9. The process has a gain of 1.0 and is composed of two time constants, 2.26 and 0.86 minutes, and a dead time lag of 0.4 minute. The time constants appear to be (1) the time constant of the reboiler and column up to the thermowell and (2) the time constant of the thermowell and resistance bulb. The dead time is believed to be the transportation lag of the flow of vapors from the reboiler up to the control tray. The thermowell and resistance thermometer time constant checked closely with laboratory tests of similar equipment. The adjustments of the temperature controller were 0.14 repeat per minute reset rate and 20 percent proportional band.

Experience had shown that with these temperature controller adjustments the system was stable under normal operating conditions. However,

TABLE 1. System Parameters

	Prop. Band	Reset Rate	Time Constants	Dead Time	Open Loop Gain
TRC:					
Before	20%	0.14 R/min.			
After	10%	0.50 R/min.			
FRC	50%	0.33 R/min.			
Temperature Process Before			2.26-0.86	0.4	1.0
Temperature Process by Step			2.26-0.72	0.3	1.0
Flow Process			0.45	0	2.89
Temperature Process After			2.26-0.11	0.4	1.0

with upsets of large magnitude the system tended to be unstable. Specifically it was noticed that at reduced heat medium flow rates continuous cycling occurred. One factor contributing to this characteristic was mathematically determined and will be explained later.

It will be recalled that the primary objectives were (1) to increase the speed of response of the system to set point changes and (2) to improve the stability. The response speed can be increased by reducing the time constants and the improvement of stability without decreasing speed of response lies essentially in reducing the phase lag. In this case the large time constant and the dead time which is a major cause of phase shift were within the process.

It was thought that both the time constant and dead time could be reduced by relocating the temperature sensing element on a tray nearer the reboiler outlet. To investigate this possibility, the dynamic temperature profile tests referred to previously were made to find the temperature response characteristics of the various trays in the bottom section of the column. These step response tests produced some interesting data. The amount of temperature change at the reboiler outlet and on the first tray, and from the 12th to the 14th trays was of the same order of magnitude. From the 2nd tray to the 5th tray there was an initial change of temperature in an inverse direction. From the 6th tray to the 12th tray very little temperature change could be detected. From these data it was considered advisable not to relocate the point of temperature measurement at that time.

It was considered possible and practical to reduce the time constant of the temperature sensing element. This could be accomplished by the use of a pneumatic temperature transmitter with derivative response. The derivative time constant would in effect compensate for the thermowell time constant. Laboratory investigation indicated that the 0.86 minute time constant could be reduced to 0.1 minute. This means that the temperature sensing element could then follow temperature changes at a much faster rate. As a consequence the process becomes easier to control.

After the desirable alterations to the process control equipment were determined the controller adjustments were next investigated. It was found that the proportional band could be decreased from 20 percent (gain of 5) to 10 percent (gain of 10) and the reset rate increased from 0.14 repeat per minute to 0.5 repeat per minute.

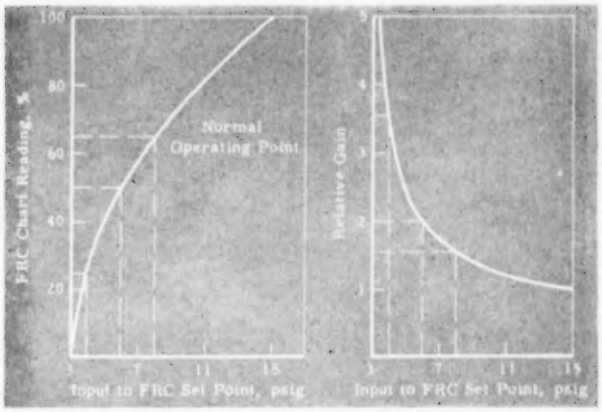


Figure 11. Changes of gain in temperature control loop due to square root flow characteristic.

Figure 10 shows open loop frequency response curves of the complete temperature control system. Curve (1) is the response of the system before making any alterations. Curve (3) shows the improvement that can be made by reducing the time constant of the temperature measuring element, with the controller adjustments unchanged. Curve (2) is the response with the controller's proportional band set at 10 percent and the reset rate at 0.5 repeats per minute. It will be noted in curves (2) and (3) that the gain remains above the 0 db. (or gain of 1) level and that the 180° phase shift point appears at a higher frequency than in the curve representing the unimproved system. This produces an increase in frequency band width which represents an increase in speed of response of the control system. Transient recovery curves following step upsets will now show faster recovery than that obtained with the original system.

The conventional type of rate action would be of little value in this application due to the amount of dead time. Dead time increases phase lag without causing a decrease in gain. To compensate for this a rate unit giving a large phase advance but low gain is required. In most rate units an increase in gain is inherent with phase advance.

It should be emphasized that the curves in Figure 10 represent the temperature control system when the heat medium flow rate was at its normal value, which was about 6.5 on the flow chart. It can be seen in Figure 11 that if for any reason the heat medium flow is reduced the gain of the temperature control system is increased. This is due to the square root relationship between air pressure input to the FRC set point mechanism and the resulting flow changes.

Conclusions—It has been shown that step response and frequency response tests can be made without seriously disturbing operating plants. At present the tests are comparatively time consuming and involve considerable effort and expense. However, it is only by gaining practical experience that improved techniques and equipment can be developed.

The tests provide data which allow practical application of frequency response methods for solving process control problems. Perhaps even of more importance, however, is that the information provides a better understanding of the behavior of control loops when operating as an integral part of an over-all complex system. The benefits lie therefore not only in the development of process equipment with improved response characteristics but in the design of better control system circuitry.

ACKNOWLEDGMENT

The authors wish to express appreciation to the Shell Oil Company Wood River, Ill., refinery for providing the opportunity for making the test. Particular thanks are due to A. J. Woods and members of his operating department for their cooperation and helpful suggestions and to W. E. Boyle and his staff for their help in conducting the tests. Special mention is also due the following members of the Shell Development staff; to G. Lindsey for his able assistance in conducting the tests; E. G. Holzmann, P. E. A. Cowley, W. J. Deissinger and A. Bremer for their contributions in the analysis and presentation of the data.

LITERATURE CITED

[1] Dynamic Behaviour of Pneumatic Devices, N. Gould, P. E. Smith, I.S.A. Paper, No. 52-9-2.

[2] Frequency Response Analysis, W. I. Caldwell, Taylor Technology, Vol. 4, No. 2.

[3] Instrument Evaluation by Frequency Response, R. D. Stanton, S.C.M.A. Short Course, 1952.

[4] New Tools for Instrument Engineers, R. E. Clarridge and W. J. Berk, Chem. Eng., May, 1952.

[5] Ziegler, J. G., and Nichols, N. B., Transactions ASME, 1941.

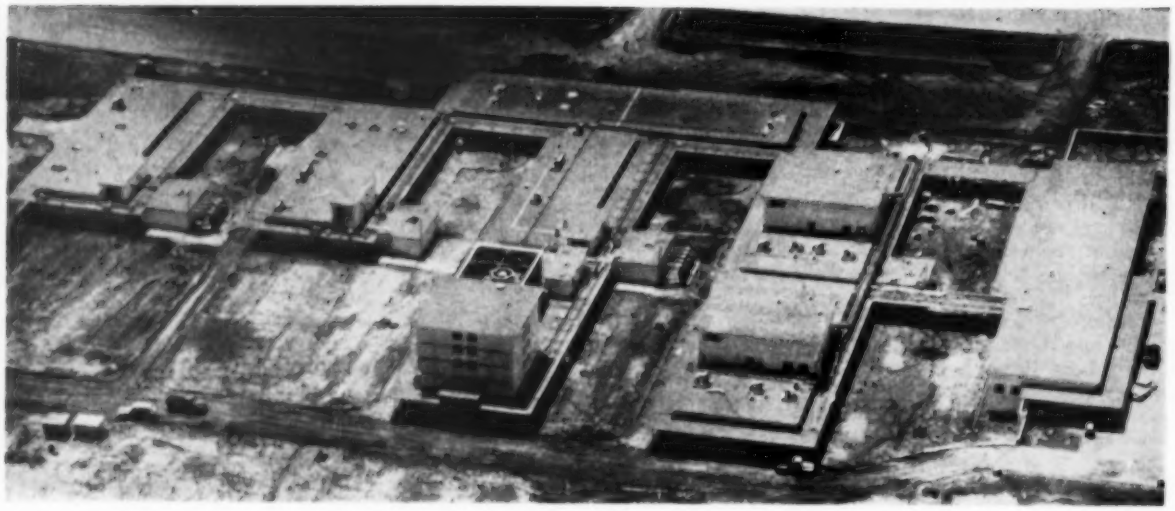
[6] The Dynamics of Automatic Controls, R. C. Oldenbourg and H. Sartorius, Pages 76-79.

[7] An Introduction to the Theory of Control, R. H. MacMillian.

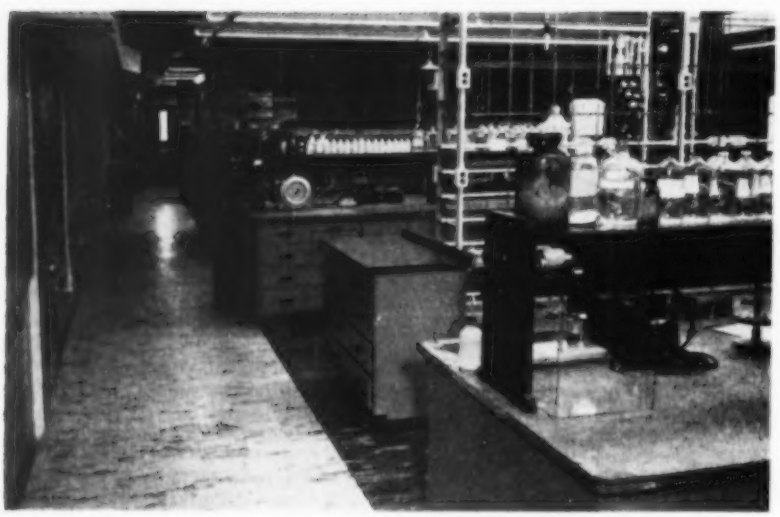
[8] Network Analysis and Feedback Amplifier Design, H. W. Bode.

[9] Servomechanisms and Regulating System Design, H. Chestnut, R. W. Mayer.

[10] Principles of Servomechanisms, G. S. Brown, D. P. Campbell.



Aerial view of Dow's new research center, Freeport, Texas



One of the many laboratories in the center is this electro-chemical laboratory.

New Research Center

Dow opens $2,600,000 research laboratory at Freeport, Texas.

RESEARCH facilities of The Dow Chemical Company are to be expanded this month with the opening of the W. R. Veazey Research Center at Plant B in Freeport, Texas.

Ground for the eight-building, $2,600,000 project was broken last year with a magnesium spade wielded by Dr. Veazey, a Dow director for 26 years, who was formerly a chairman of the executive research committee and one of the pioneers of the Dow magnesium process.

One of the new buildings is occupied by the library and offices; two others contain a portion of the Organic Laboratory; two are occupied by the Chemical Engineering department; two by the Central Laboratory and the Electrochemical Engineering department; and the eighth by shops and the stockroom.

The Research Center will be used by the Organic and Technical Research group of the Texas Division. The director of the Organic Laboratory is E. B. Barnes of Freeport. Director of Technical Research is C. M. Shipley of Lake Jackson, Texas. The Organic group does research mainly in petrochemical products and processes, plastics, and synthetic resins. The Technical Research group does research in new products and processes, construction materials, instrument development, electrochemistry, corrosion control, and agriculture. Technical Research also does analytical work and glass blowing.

The Technical Reearch group comprises the Central Laboratory, directed by Dr. E. R. Wright of Freeport; the Chemical Engineering department, directed by W. P. Schambra of Freeport; the Electrochemical Engineering department, directed by Oliver Osborn of Lake Jackson; and the Agricultural Research department, of which Dr. R. H. Colby of Lake Jackson is director.

Not all of the Texas division research personnel will be housed in the research center. The organic laboratory has pilot plants and other laboratory groups at Plant A and B. A relatively small part of this group is to be stationed in the research center.

The Technical Research group also has extensive developmental operations at other locations in Plants A and B and Lake Jackson (Agricultural Research).

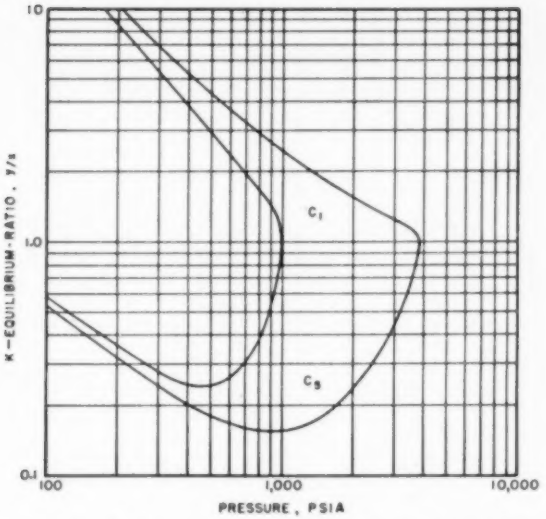


Figure 1. Effect of pressure and composition on equilibrium-ratios of methane and pentane at 160 F.

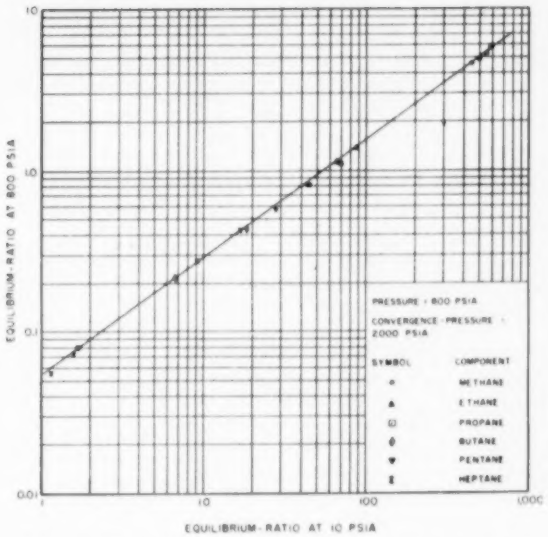


Figure 2. Effect of component identity on equilibrium-ratios.

A direct method for predicting . . .

Vapor-Liquid Equilibrium Ratios

Part I. The general method applied to binary systems

Part II. Ternary and multicomponent systems

- A direct solution, no trial-and-error
- Applicable to paraffins and olefins
- Pressures up to 10,000 with high accuracy

J. M. Lenoir and G. A. White, C. F. Braun & Co., Alhambra, Calif.

MANY OPERATIONS in the petroleum, natural gasoline and the petrochemical industry depend upon reliable predictions of equilibrium-ratios for suitable design and successful performance—fractionation, absorption, vacuum-flashing, crude-separation, and so on. This article describes a method of computing directly equilibrium-ratios of paraffin and olefin hydrocarbons without the need for a cumbersome trial-and-error solution. The direct solution is accomplished by reducing the number of independent variables that must be estimated in the computation of $K = y/x =$ mole fraction in vapor/mole fraction in liquid. The authors have found that three things completely define equilibrium-ratios for components in all mixtures of aliphatic hydrocarbons.

(1) The equilibrium-ratio at the operating-temperature and at some low pressure, below 100 psia.

(2) The operating-pressure. And

(3) the convergence-pressure.

Convergence-pressure is a measure of vapor and liquid compositions of binary mixtures at equilibrium. Two things determine the convergence-pressure of binary mixtures—temperature and the identity of the two compounds. This present prediction-method uses hypothetical binaries to compute convergence-pressures of ternary and multicomponent mixtures. This is done by identifying the hypothetical components by effective boiling-points. Normal boiling-points of the individual compounds are used to compute the effective boiling-points of the lighter and heavier components.

Briefly, the method consists of first obtaining equilibrium-ratios for each component at 10 psia and at the operating-temperature. For mixtures of more than two compounds, the effective boiling-points are computed

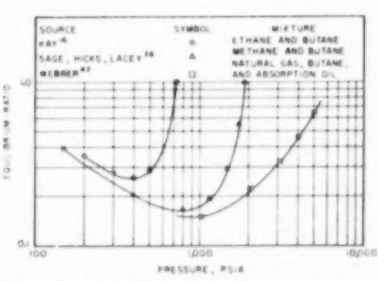


Figure 3. Equilibrium-ratios of n-butane at 100 F. in mixtures with ethane, methane, and natural gas in absorption oil.

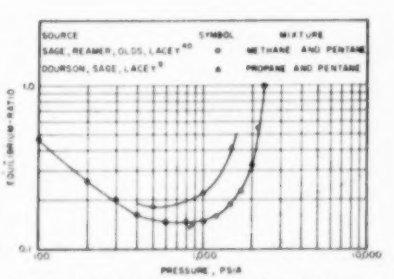


Figure 4. Equilibrium-ratios of n-pentane at 160 F. in mixtures with methane and propane.

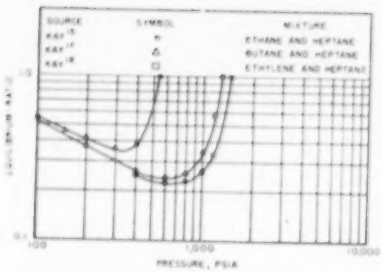


Figure 5. Equilibrium-ratios of heptane at 310 F. in mixture with ethane, butane, and ethylene.

for the representative components. Charts are used to get the convergence-pressure of the mixture. Knowing the equilibrium-ratios at 10 psia and the convergence-pressure of the mixture, equilibrium-ratios at the operating-pressure are found on generalized charts.

Several earlier methods, based on the Lewis-Randall rule, are available for predicting equilibrium-ratios satisfactorily for pressures below about 100 psia. Four such methods are those developed by Lewis,[21] Kirkbride,[20] Brown,[13] and Maxwell.[23] In each of the four methods, the assumption is made that composition is not important. But experimental data show that this assumption does not hold for high pressures.

Smith and Watson,[42] and Benedict,[1] have developed methods that consider composition as a variable. These two methods predict equilibrium-ratios up to pressures of 10,000 psia with good accuracy. But in both methods, it is necessary to estimate liquid and vapor compositions. Then the estimated compositions are used to predict equilibrium-compositions. This trial-and-error solution must be repeated until the estimated composition is the same as the computed equilibrium-composition.

The present method like the methods of Smith and Watson,[42] and Benedict[1] considers that equilibruim-

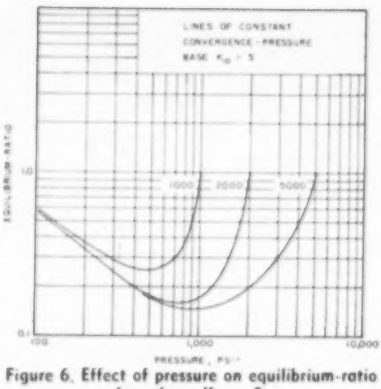


Figure 6. Effect of pressure on equilibrium-ratio from base $K_{10} = 5$.

ratios are functions of four independent variables—component-identity, temperature, pressure, and composition. This is illustrated in Figure 1. Composition has little effect on equilibrium-ratios at low pressures, but a large effect at high pressures.

Hanson and Brown[13] have shown that the equilibrium-ratios for paraffins at high pressures, depend on the temperature and the convergence-pressure of the mixture. Convergence-pressure is thus a useful variable, since many mixtures may have the same convergence-pressure. In Figure 1, a single isothermal curve represents equilibrium-ratios for one component, pentane for example, in all mixtures that have the same convergence-pressure.

Families of isothermal curves may be drawn to represent equilibrium-ratios for compounds in all mixtures that have the same convergence-pressure. The relationship between component curves in an isothermal family is independent of temperature for a constant convergence-pressure. This can be shown by plotting experimental equilibrium-ratios at 10 psia against those at 300 psia for a wide range of temperatures, as in Figure 2.

The data in Figure 2 represent six compounds in six separate mixtures,

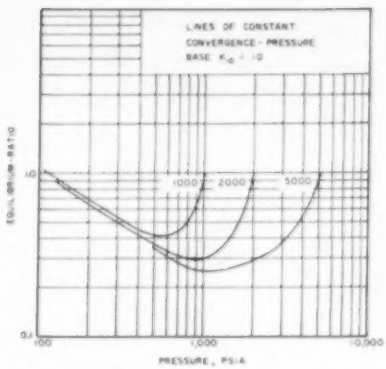


Figure 7. Effect of pressure on equilibrium-ratio from base $K_{10} = 10$.

all having the same convergence-pressure. Mixture-temperatures range from 100 to 360 F. The plot shows that the equilibrium-ratios can be represented by a single curve. This means that, for a given convergence-pressure, equilibrium-ratios at the system-temperature and 10 psia can be used to predict equilibrium-ratios at 300 psia. The use of 300 psia in Figure 2 was dictated by the availability of reliable data at this pressure. But equilibrium-ratios at any pressure can be predicted from the value of the ratio at 10 psia and a knowledge of the convergence-pressure of the system.

The authors used experimental data from the literature to construct families of curves for hydrocarbon mixtures having different convergence-pressures. Figures 3, 4, and 5 are typical plots of experimental data for butane, pentane, and heptane. The curves representing experimental data were then cross-plotted to establish curves of equilibrium-ratio at 10 psia against equilibrium-ratio at pressures up to 10,000 psia for constant convergence-pressure. And then, the curves as in Figure 2, were used to establish families of curves of equilibrium-ratio at 10 psia against pressure, with convergence-pressure as the parameter.

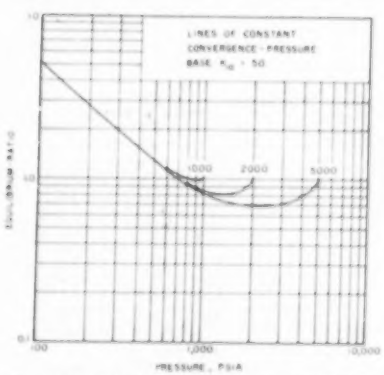


Figure 8. Effect of pressure on equilibrium-ratio from base $K_{10} = 50$.

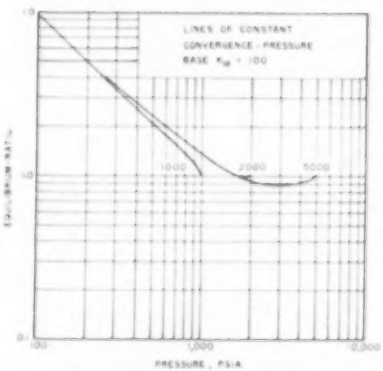


Figure 9. Effect of pressure on equilibrium-ratio from base $K_{10} = 100$.

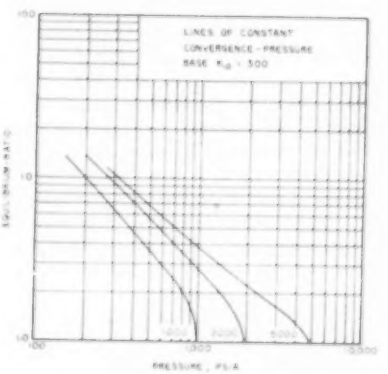


Figure 10. Effect of pressure on equilibrium-ratio from base $K_{10} = 300$.

Nomenclature

C — Designation for component
c — Composition of liquid-phase
EBP — Effective boiling-point
F_e — Multiplying factor to compute effective boiling-points
i — Identity of component
K — Equilibrium-ratios
K_{10} — Equilibrium-ratio at 10 psia
P — Pressure
P_c — Convergence-pressure
t — Temperature, F
T — Temperature, R
y — Mole fraction, vapor-state
x — Mole fraction, liquid-state

Subscripts

EH — "Effective" heavier component
EL — "Effective" lighter component
H — Heavier component
I — Intermediate component
L — Lighter component

Figures 6, 7, 8, 9, and 10 illustrate the types of curves that are used to predict equilibrium-ratios up to 10,000 psia for any component whose equilibrium-ratio at 10 psia is between 5 and 300. Additional curves, not shown here, are used to completely define equilibrium-ratios over the entire operating range. With a complete set of curves, linear interpolation may be used when equilibrium-ratios at 10 psia lie between consecutive charts.

Sample calculation: Calculate the equilibrium-ratios of methane and n-butane in a mixture at 100 F. and 1000 psia. The mixture, at 100 F. has a convergence-pressure equal to 1912 psia.

First use Figure 11 to get the equilibrium-ratio at the operating-temperature and 10 psia. For methane, $K_{10} = 290$, and for n-butane, $K_{10} = 5.0$. Then use Figure 6 to get $K_{1000} = 0.18$ for n-butane. Using linear interpolation between Figures 9 and 10 get $K_{1000} = 2.7$ for methane. Experimental values have been determined[36] as $K = 2.78$ for methane, and $K = 0.174$ for n-butane.

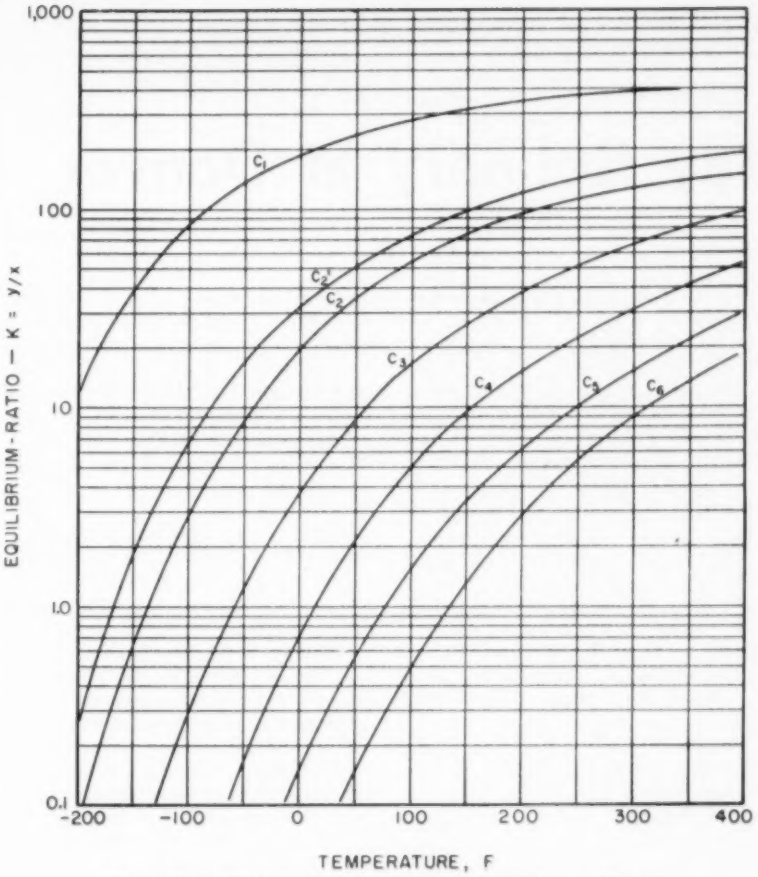


Figure 11. Equilibrium-ratios of n-paraffins and ethylene at 10 psia.

REFERENCES

[1] Benedict, M., et al. Liquid-Vapor Equilibrium in Mixtures of Light Hydrocarbons. M. W. Kellogg Co. (1950).
[2] Benedict, M., Solomon, E., and Rubin, L. C. Methane-Ethylene-Isobutane System. Ind. Eng. Chem., **37,** 55 (1945).
[3] Hillman, G. W., Sage, B. H., and Lacey, Methane-Ethane-Pentane System. AIME, Tech. Pub. 2232 July (1947).
[4] Boomer, E. H., and Johnson, C. A. Methane-Hexane System. Canadian Jrl. of Res., 16B, 328.
[5] Boomer, E. H., Johnson, C. A., and Piercey, A. G. A. Methane-Pentane System. Canadian Jrl. of Res. 16B, 319.
[6] Boomer, E. H., Johnson, C. A., and Piercey, A. G. A. Methane-Heptane System. Canadian Jrl. of Res., 16B, 396.
[7] Carter, R. T., Sage, B. H., and Lacey, W. N. Methane-Propane-n-Pentane System. AIME, No. 1250.
[8] Cummings, L. W. T., Stones, F. W., and Volante, M. W. Pentane-Heptane System. Ind. Eng. Chem., **25,** 728 (1933).
[9] Dourson, R. H., Sage, B. H., and Lacey, W. N. Methane-Propane-n-Pentane System. AIME, No. 1490.
[10] Gilliland, E. R. and Scheeline, H. W. Propylene-Isobutane. Ind. Eng. Chem. **32,** 48 (1940).
[11] Goff, Farrington, and Sage. Propene-1-Butene System. Ind. Eng. Chem. **42,** 735 (1950).
[12] Guter, M., Nevitt, D. M., and Ruhemann, M. Methane-Ethane System, and Methane-Ethylene, Proc. Roy. Soc. (London) A176, 140 (1940), and A176, 146 (1940).
[13] Hanson, G. H., and Brown, G. G. Equilibria in Mixtures of Volatile Paraffins. Ind. Eng. Chem., **37,** 821 (1945).
[14] Katz, D. L., and Kurata, F. Ind. Eng. Chem., **32,** 817 (1940).
[15] Kay, W. B. Liquid-Vapor Phase Equilibrium Relations in the Ethane-n-Heptane System. Ind. Eng. Chem., **30,** 459 (1938).
[16] Kay, W. B. The Ethane-n-Butane System. Ind. Eng. Chem., **32,** 353 (1940).
[17] Kay, W. B. The N-Butane-n-Heptane System. Ind. Eng. Chem., **33,** 590 (1941).
[18] Kay, W. B. The Ethylene-n-Heptane System. Ind. Eng. Chem., **40,** 1459 (1948).
[19] Kirkbride, C. G. Fugacity Chart, Petroleum Refiner, December (1945).
[20] Kirkbride, C. G., and Bertetti, J. W. High Pressure Absorption of Low Boiling Hydrocarbons. Ind. Eng. Chem., **35,** 1242 (1943).
[21] Lewis, W. K., and Luke, C. N. Vapor-Liquid Equilibria of Hydrocarbons at High Pressure. Ind. Eng. Chem., **35,** 725 (1933).
[22] McKay, R. A., Reamer, H. H., Sage, B. H., and Lacey, W. N. Ethane-Propene. Ind. Eng. Chem., **43,** 2112 (1951).
[23] Maxwell, J. G. Data Book on Hydrocarbons. D. Van Nostrand, New York (1950).
[24] Mayfield, F. D. Ind. Eng. Chem., **74,** 843 (1947).
[25] Nederbraght, G. W. Methane-n-Butane System. Ind. Eng. Chem., **30,** 587 (1938).
[26] Nysewander, C. N., Sage, B. H., and Lacey, W. N. Propane-n-Butane. Ind. Eng. Chem., **32,** 118 (1940).
[27] Olds, R. H., Sage, B. H., and Lacey, W. N. Methane-Isobutane System. Ind. Eng. Chem., **34,** 1008 (1942).
[28] Reamer, H. H., Fiskin, J. M., and Sage, B. H. Methane-Butane-Decane System. Ind. Eng. Chem., **41,** 2871 (1949).
[29] Reamer, H. H., and Sage, B. H. Propene-Propane System. Ind. Eng. Chem., **43,** 1628 (1951).
[30] Reamer, H. H., Sage, B. H., and Lacey, W. N. Methane-Propane System. Ind. Eng. Chem., **42,** 534 (1950).
[31] Reamer, H. H., Sage, B. H., and Lacey, W. N. Methane-Butane-Decane System. Ind. Eng. Chem., **43,** 1436 (1951).
[32] Roland, C. H. Vapor-Liquid Equilibria for a Natural Gas-Crude Oil Mixture. Ind. Eng. Chem., **37,** 930 (1945).
[33] Roland, C. H., Smith, D. E. and Kaveler, H. H. Equilibrium Constants for a Gas-Distillate System. O. & G. Jrl., 128 (1941).
[34] Ruhemann, M. Proc. Roy. Soc., **171A,** 121 (1939).
[35] Sage, B. H. Equilibrium Constants for Methane in Several Hydrocarbon Systems. Ind. Eng. Chem., **30,** 1297 (1938).
[36] Sage, B. H., Hicks, B. L., and Lacey, W. N. Methane-n-Butane System. Ind. Eng. Chem., **32,** 1085 (1940).
[37] Sage, B. H., and Lacey, W. N. System 1-Butene-n-Butane. Ind. Eng. Chem., **40,** 1299 (1948).
[38] Sage, B. H., and Lacey, W. N. Propane-Pentane System. Ind. Eng. Chem., **32,** 992 (1940).
[39] Sage, B. H., Lacey, W. N., and Schaafsma, J. G. Methane-Propane System. Ind. Eng. Chem., **26,** 214 (1934).
[40] Sage, B. H., Reamer, H. H., Olds, R. H., and Lacey, W. N. Methane-n-Pentane System. Ind. Eng. Chem., **34,** 1108 (1942).
[41] Scheeline, H. W., and Gilliland, E. R. Propane-Isobutylene. Ind. Eng. Chem., **31,** 1050 (1939).
[42] Smith, K. A., and Watson, K. M. Activity Coefficients for Ideal Systems. Chem. Eng. Prog. **45,** 494 (1949).
[43] Souders, M., Selheimer, C. W., and Brown, G. G. Ind. Eng. Chem., **24,** 517 (1932).
[44] Standing, M. B., and Katz, D. L. Natural Gas-Crude Oil System. AIME, No. 1651.
[45] Stutzmen, L. F., and Brown, G. M. Low Temperature Vapor-Liquid Equilibria. Chem. Eng. Prog., **45,** 139 (1949).
[46] Vaughn, W. E., and Collins, F. C. Propane-Isopentane. Ind. Eng. Chem., **34,** 885 (1942).
[47] Webber, C. E. Equilibrium Constants for Hydrocarbons in Absorption Oil. AIME, No. 1252.

End of Part I. Part II will appear in an early issue.

One of the largest in the Rocky Mountain Region . . .

Bay Refinery at Denver

BAY PETROLEUM Corporation completed a multi-million-dollar expansion and modernization program at its refinery in Denver recently when its new UOP Fluid catalytic cracking unit went on stream. With installation of the cat cracker and extensive revamping of some existing facilities, Bay's Denver refinery is now one of the largest in the Rocky Mountain region.

The new cat cracker is designed for 3528 barrels per stream day of gas oil fresh feed at 76 percent conversion with a coke-burning capacity of 3770 pounds per hour. It is producing gasoline which has an octane rating above 91 without the addition of tetraethyl lead.

Universal Oil Products Company designed, engineered and licensed the new cat cracker.

UOP engineers also redesigned and engineered the revamped facilities, which went on stream at the same time as the cat cracker. These include a crude topping unit, a visbreaker-vacuum unit converted from a Dubbs thermal cracking unit, and gas concentration and polymerization units. The poly unit was redesigned to produce 315 barrels per stream day of 10-pound polymer.

The new refinery operation is based upon charging 11,000 barrels per stream day of a blend of Wilson Creek, Lance Creek and Wellington crude oils to the revamped topping unit.

The cat cracker was constructed by Procon, Incorporated. Procon engineers also handled the revision of the poly and gas concentration facilities.

In the refinery's present operation, topped crude is being processed in a visbreaker-vacuum flashing operation in the revamped Dubbs thermal cracker. Gas oil is being used as a charge stock to the cat cracker, and the gas and gasoline from visbreaking is stabilized in the revamped gas recovery system. Visbreaker bottoms are blended with cat cycle oil to meet No. 6 fuel oil specifications. The gas recovery system utilizes as much existing equipment as possible. The polymerization of the C_3 and C_4 olefins is effected in the revamped poly plant, which consists nearly entirely of equipment from the original unit.

Blended crude oils are charged through heat exchangers to a pre-flash column, where light straight run gasoline is taken off overhead. Bottoms from the pre-flash column are pumped through a heater to the No. 1 crude column. There, a naphtha cut is taken off overhead and mixed with the light straight-run and kerosine is removed as a sidecut.

Bottoms from the No. 1 crude column are charged through a second heater to the No. 2 crude column, where diesel oil and gas oil are taken off as sidecuts. Reduced crude from the bottom of the No. 2 crude column is charged through the visbreaker heater into the flash chamber.

Vapors from this vessel are sent to a fractionating column, where the visbreaker gas and gasoline are taken overhead and sent to the cat cracker gas concentration unit. Visbreaker gas oil emanating from the bottom of the fractionating column is heat exchanged against crude, cooled and sent to storage.

Bottoms from the visbreaker flash chamber are sent to a vacuum column, where vacuum gas oil is separated from the visbreaker pitch in a flashing operation. Vacuum gas oil is condensed and sent to storage together with the visbreaker gas oil.

Visbreaker pitch from the bottom of the vacuum column is blended with cycle oil from the cat cracker unit to make the No. 6 fuel oil.

Vacuum gas oil, visbreaker gas oil and atmospheric gas oil produced in the crude unit combine to comprise the charge stock to the new cat cracker.

The high conversion cat cracker is of the latest UOP design. Gases and gasoline produced in this new unit are sent to the gas concentration plant, where all the gasoline portions from the gases are recovered as well as propane-propylene and butane-butylenes for the poly plant charge. All light gases are rejected and are vented to refinery fuel.

Propane and propylene recovery is very high, running 86½ percent, while butane and butylene recovery is essentially 100 percent.

Gases are compressed to a high pressure and sent to an absorber. Liquid emanating from interstage and high pressure receivers goes to a stripper, where ethane, H_2S and lighter materials are removed. Liquid from the low pressure receiver is used as lean oil over the primary absorber. Rich oil from the absorber and vapors from the stripper are recirculated through the high pressure receiver for reabsorption.

The recovered liquid is debutanized. Overhead fractions of C_3 and C_4 are sent to the poly plant. Bottoms go to cat cracked gasoline storage. Recovery of C_3 and C_4 and rejection of C_1 and C_2 materials is independently controlled.

A caustic and water wash system was provided to remove materials which might poison the poly catalyst. Finned tube sections, taken from other units in the refinery that were idle, were placed on the charge exchanger, charge heater and effluent cooler, and provision was made for using the catalyst chamber effluent as part of the liquid recycle because the existing fractionating columns did not have sufficient capacity to handle the required amount of the propane and butane recycle fluid. For the same reason, the de-ethanizer column was moved from its position following the catalyst tower to the depropanizer overhead.

After caustic and water wash, the fresh feed is pumped through the effluent exchanger and charge heater into the catalyst chamber. Effluent passes through the charge exchanger, where it splits. One portion goes directly to the depropanizer and part goes through the cooler into the effluent receiver, where it splits again. Part of the material is sent to the depropanizer and part is picked up by a pump and used as recycle fluid.

As much propane recycle is used as is permitted by the capacity of the depropanizer. The remainder of the depropanizer overhead is charged to the de-ethanizer, where it is split into gas which is vented to the refinery fuel system and LPG for sale.

Depropanized bottoms enter the poly stripper, where excess butane is removed overhead and 10-pound polymer is produced as a bottoms product.

Is Packed Height A Variable in Flooding?

Yes, say these investigators, and here for the first time, are the data to prove it. The study of the effect of packed height on flooding has been neglected in the past.

William Meese Newton, T. Brooks Metcalfe* and J. W. Mason
Georgia Institute of Technology,
Atlanta

CONCLUSIONS

(1) The effect on flooding of packed height is appreciable at low liquid rates, decreases with increasing liquid rate and is negligible at liquid rates above 2½ pounds per second foot.[2]

(2) There is a minimum height of any packing below which flooding velocity is a function of packed height.

(3) In general this minimum height is not more than five feet.

(4) For Raschig rings the minimum is lower than any practicable height and the effect can be considered negligible.

(5) In selecting a generalized correlation, it would be wise to avoid those which are based on data from columns having the possibility of height effect without making correction for such effect.

PACKED HEIGHT is one variable affecting flooding of packed towers which has been completely neglected. It is true that it is not as obvious or significant a variable as density and viscosity. Numerous other variables have been investigated, some found to be of no consequence, and others used successfully to correlate flooding data. Except indirectly, no attention has been paid to height of the packed section.

In a packed column there is for every rate of liquid flow a certain gas velocity which causes the column to fill with liquid. This is called the flooding velocity. Under these conditions the liquid is forced upward through the bed making countercurrent contact impossible and the pumping requirements for the gas become excessive.

Since the maximum mass transfer efficiency for a given tower is achieved in a relatively narrow range of flow rates of gas and liquid, the tower should be designed so that the anticipated throughput will give velocities in this range. This optimum range extends from velocities slightly below flooding up to flooding velocities. For this reason large allowances for safety from flooding are undesirable and the column should be designed as close to optimum conditions as possible.

Many investigators have reported flooding velocities on a wide variety of different packings. The usual system has been air flowing against water but some work has been done on other fluids. Most of the common sizes of each of the types of packing are represented in available published data and many sizes of towers have been used. Diameters from two to eight inches and larger are reported and packed heights from two to five feet. However each investigator usually restricted himself to one column and one packed height. It is now evident that the packed heights of some of the towers from which data was taken were unfortunately of insufficient height to give data of general applicability.

White[1] has presented data obtained from several undergraduate research projects at the University of North Carolina which includes flooding velocities for air against water through several sizes of Raschig rings in three and six inch diameter columns packed five feet high. These data have been used in correlations by Sarchet,[2] Elgin and Weiss,[3] and by Sherwood, Shipley and Holloway.[4]

Sherwood, Shipley and Holloway packed a two-inch diameter column to a height of four feet with half-inch carbon Raschig rings. Based on data for several systems of different fluids in which the density, viscosity and surface tension were varied, a correlation was devised for Raschig rings which agreed satisfactorily with the data of other investigators for a wide variety of tower sizes and different systems and packings. This correlation has been used widely for all types of packings and the full range of tower sizes.

Elgin and Weiss found reasonable agreement between the Sherwood curve and their data for flooding of a three-inch diameter column packed 4.67 feet high successively with Raschig rings, Berl saddles and porcelain balls. They used a water-air system and observed that, when the gas rate was slowly increased with a constant liquid rate, a certain gas velocity was reached at which the column began to slowly fill with liquid. This they called the flood point. In most cases filling appeared to them to commence in the lower section of the tower.

Sarchet made his measurements in an eight-inch column packed two feet high with two sizes of Raschig rings and also with a special ribbed ring packing.

Schoenborn and Dougherty[5] used the same equipment in which Sarchet had made his measurements and also used two feet of packed height. The systems selected for consideration were so chosen as to give a wide variation in viscosity. The resulting em-

TABLE OF NOMECLATURE

F	Fractional free void volume of packed section	
g	Gravitational constant, ft./sec.^{2}	
G	Superficial* gas mass rate of flow, lb/sec ft.^{2}	
L	Superficial* liquid mass rate of flow, lb/sec ft.^{2}	
S	Surface of packing, ft.^{2}/ft.^{3}	
U	Superficial* linear gas velocity, ft./sec.	
P_G	Density of gas, lb/ft.^{3}	
P_L	Density of liquid, lb/ft.^{3}	
μ	Viscosity of liquid, centipoise	

*Based on the cross sectional area of the empty column.

* Present address of Mr. Metcalfe is Shell Oil Company, Houston.

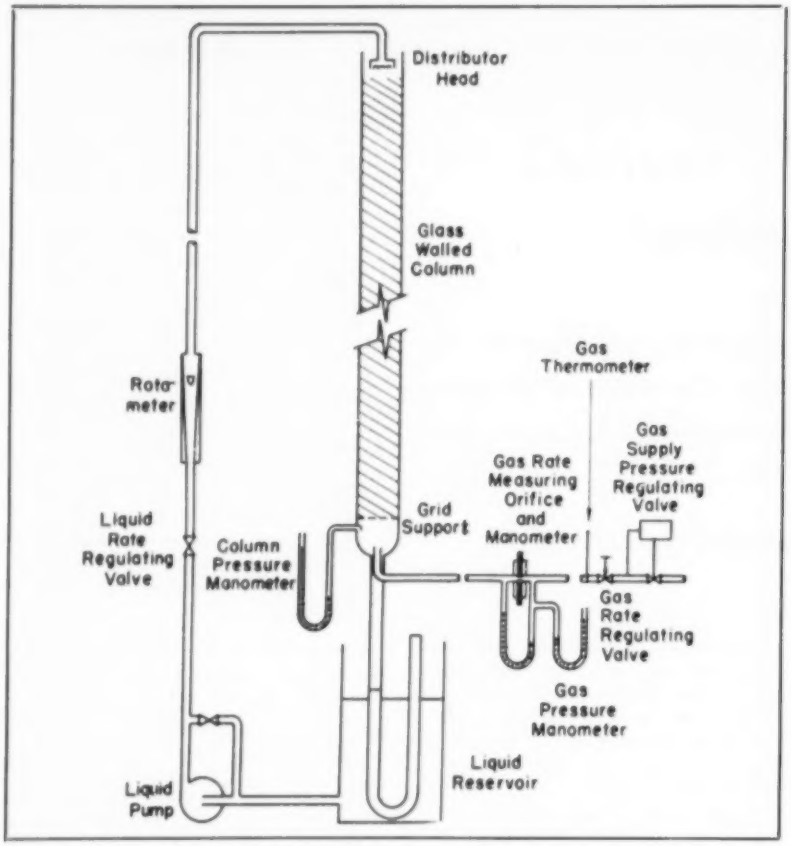


Figure 1. Schematic diagram of packed height equipment.

pirical correlation fits the data of these investigators quite closely.

The eight-inch tower used by Bain and Hougen[6] was packed to a height of four feet with several sizes of Berl saddles and Raschig rings and also with wire helices. The elimination of "end effects" was attempted by taking the pressure measurements at points six inches above the packing support and six inches below the top of the packing. These effects were found to be negligible in their column. They found flooding of a tower packed with Berl saddles to be initiated in each case at the packing support while flooding of their Raschig ring packed columns always began on the top of the packed section. Correlation of their data by the method of Sherwood, et al., gave curves of the same general shape but that for Berl saddles showed higher flooding velocities while that for Raschig rings showed lower velocities than those which were predicted by the Sherwood curve.

Baker, Chilton and Vernon[7] studied the distribution of water in packed columns as a function of the distance down the column from the top of the packing. They packed 3, 6, 12 and 24-inch diameter columns successively with ½ and 1-inch Berl saddles, ½ and 1-inch Raschig rings, ½, ¾ and 1-inch spheres and a variety of other types of packing. At a liquid rate of 0.14 pounds per second foot,[2] they found about four feet of descent over most packings to be required for attainment of reasonably even distribution of the liquid over the cross section of the column. They showed that in the cases of the Raschig rings less height (about two feet) was required. This was shown to be true even for a distributor head with nineteen points of distribution over the top of the packing.

Equipment

The present investigation was conducted in the equipment discussed by Newton, Mason, Metcalfe and Summers[8] (see Figure 1). Columns of two, four and eight-inch diameter glass tubing were used. The packing was supported on half-inch mesh screen. In no case did flooding originate at or near this packing support. In the cases of the small size packings a layer of half-inch packing was laid down first to prevent passage of the smaller size pieces through the half-inch mesh. In all cases the packing was dropped piece by piece into the column full of water and allowed to settle into place. This method gave the greatest assurance of completely ran-

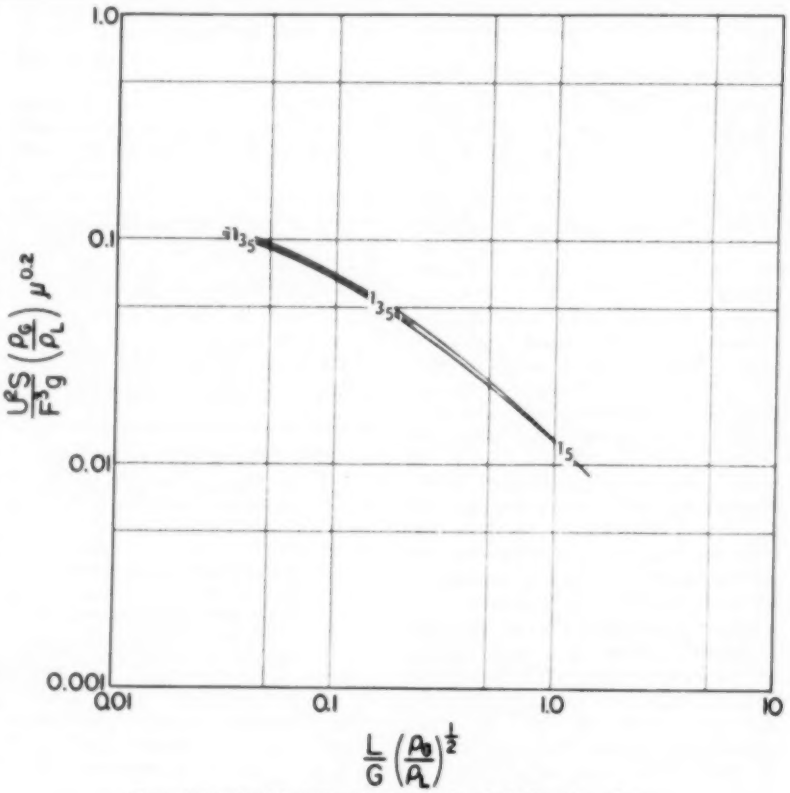


Figure 2. One-half-inch Raschig rings in four-inch diameter column. (Numbers refer to packed height in feet.)

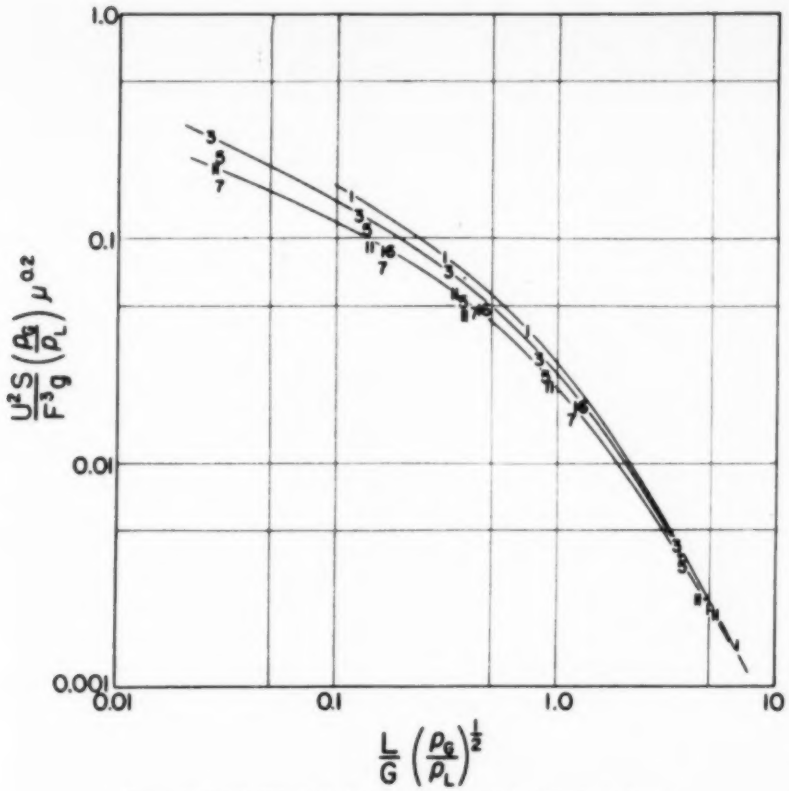


Figure 3. One-half-inch Berl saddles in four-inch diameter column. (Numbers refer to packed height in feet.)

dom orientation of the pieces in the bed. The pressure drop across the packed section during flow was measured by a water filled manometer connected to the bottom of the column.

In all cases flooding velocities were measured with water against air. The water was pumped from a sump up to the distributor at the top of the column through one of a bank of three rotameters of appropriate sizes to measure the wide range of flows required. Air from a compressor operating on a 90-120 psig cycle was regulated to 75 psig and passed through a cyclone separator and a fibre glass filter. Three sizes of orifices, installed according to the specifications of the ASME "Special Committee for Fluid Meters,"[9] were used to measure the air flows. The density of the air was calculated from the upstream pressure and temperature as measured by a mercury filled manometer and a mercury thermometer.

Procedure

The flooding rates were obtained in the column by setting the flow of water at a constant rate and increasing the air flow rate in small increments until flooding of the column resulted. After each small increase no readings were taken until steady state was assured by a constant pressure drop across the packed section. A logarithmic plot of the resulting pressure drop and gas rate measurements gave the flooding velocities as defined by White.[1] According to this definition the velocities represented by the point at which the slope of this curve becomes greater than 1.8 are flooding rates.

For assurance of adequate distribution from the distributor heads check runs were made under all of the same conditions except manner of distribution. No noticeable effect was discovered for variation of number or size of distribution points or of the height (up to three inches) of the distributor above the packing. In no case was the formation of spray or direct impingement of a jetted stream upon the packing allowed.

Results and Discussion

Different types of packings exhibit different degrees of the effect of packed height on flooding rates. Data obtained by the authors in the Chemical Engineering laboratories at Georgia Tech on this effect in columns packed with Raschig rings are represented by the plots in Figure 2. While small, the effect is consistent. These data are substantiated by an extensive program of work on Raschig rings done in the same laboratory by McManus.[10]

The flood point of columns packed

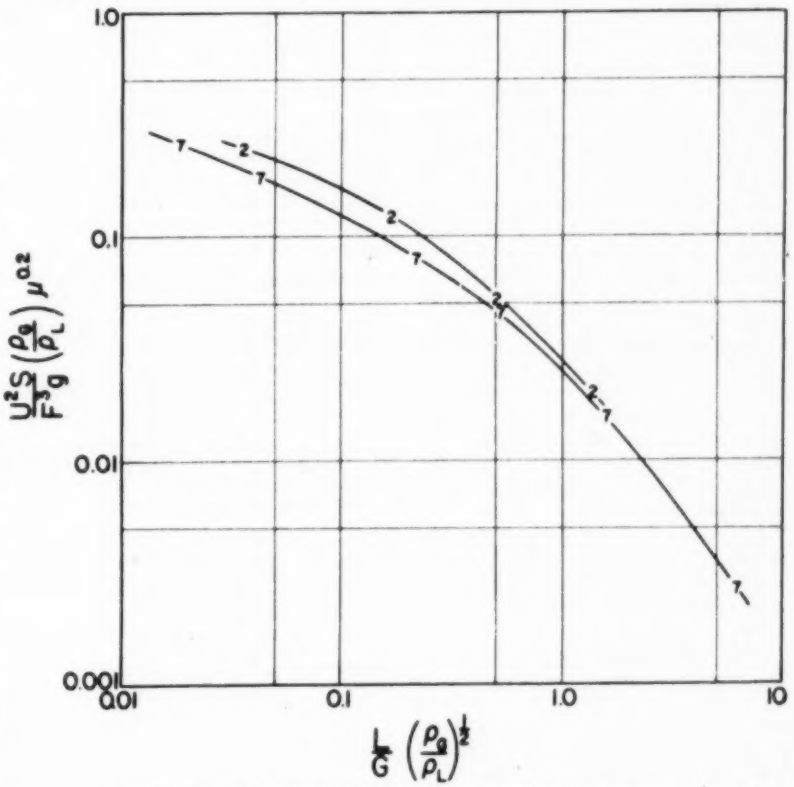


Figure 4. Five-eighths-inch glass spheres in four-inch diameter column. (Numbers refer to packed height in feet.)

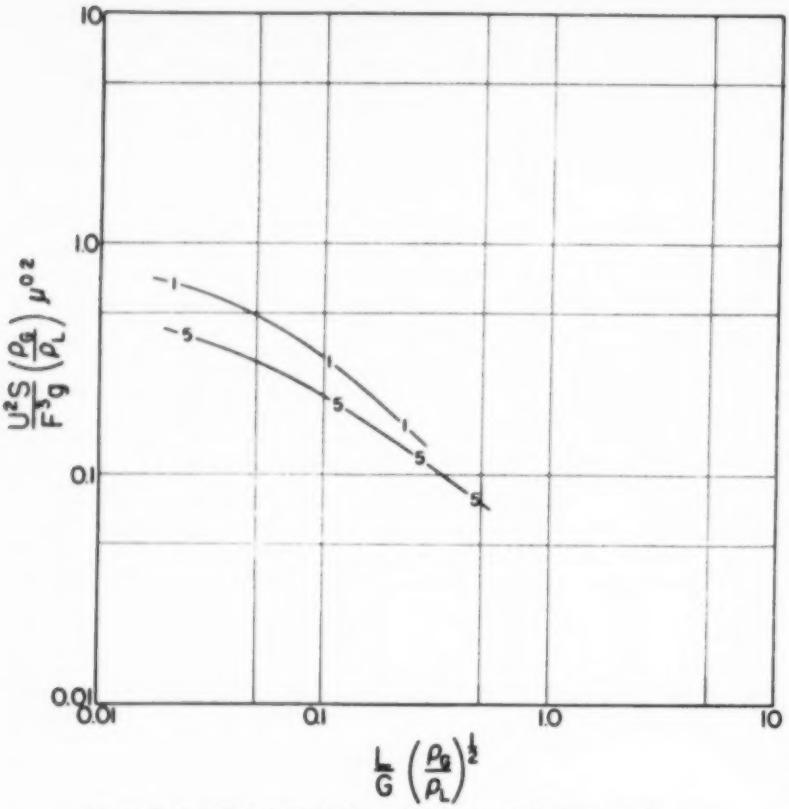


Figure 5. One-half-inch interlocking saddles in four-inch diameter column. (Numbers refer to packed height in feet.)

with other types of packing is affected to a greater extent by packed height. This effect for ⅝-inch spheres, ½-inch Berl saddles and ½-inch "interlocking" saddles (a new packing supplied by U. S. Stoneware) is illustrated in Figures 3, 4 and 5. In all cases studied of each packing size and type in one of three sizes of columns (2 inch, 4 inch and 8-inch diameter) there is a definite effect of height at low packed heights, which is greatest at low liquid rates and becomes negligible at liquid rates above 2½ pounds per second foot^2 for any packed height. Even at the low liquid rates there is a characteristic height above which no additional effect of added packing is evident. This is the minimum height for negligible effect of packed height.

In none of the columns was the minimum height for no height effect more than seven feet. In general the minimum height was between 3.5 and 5 feet.

The effect of packed height on flooding is attributed by Metcalfe[11] to lack of even distribution of liquid until it has descended over a minimum height of packing. The minimum heights for no height effect found in this work correspond to those heights found by Baker, et al., to be required for attainment of even distribution of liquid.

There is competition between liquid and gas for the vertical passages through the packing. Flooding occurs when the relative velocities of the liquid and gas within the same passageway reaches the critical value. When the liquid is not evenly distributed it fills some of the passages completely, leaving others for the exclusive use of the gas. Just as a liquid flows uninterrupted from the pouring spout of a vented vessel so is the flow in the liquid filled passages undisturbed while the gas is "vented" to the top of the packed section through its own passages. Under such conditions flow rates, which would cause flooding under even distribution conditions, are too low to cause disturbances sufficient for flooding in any of the liquid streams, and higher flooding velocities are consequently obtained.

If the packed section is high enough (greater than the minimum height for no height effect) even distribution will be attained before the liquid flows out of the bottom and the opportunity for flooding at lower liquid rates will thus be afforded. This will explain the observation by Elgin that flooding originated "in the lower section" of his 4⅔-foot tower. At high liquid rates, vertical passages are so much in demand by liquid that none are left entirely free for gas flow and the opportunity for flooding disturbances is not noticably reduced at low heights.

ACKNOWLEDGMENTS

The writers wish to express their appreciation to the Research Committee of the Georgia Institute of Technology for financial assistance which made this work possible, and to Dr. J. Lucas of U. S. Stoneware Corp., for the loan of the interlocking saddle packing used in this work. We are also grateful for the laboratory assistance of George De Loach, Arch McNeil and Victor Goode.

BIBLIOGRAPHY

[1] White, A. M., *Trans. Am. Inst. Chem. Engrs.*, **31**, 390 (1936).

[2] Sarchet, B. R., *Trans. Am. Inst. Chem. Engrs.*, **38**, 283 (1942).

[3] Elgin, J. C., and Weiss, F. B., *Ind. Eng. Chem.*, **31**, 435 (1939).

[4] Sherwood, T. K., Shipley, G. H., and Holloway, F. A. L., *Ind. Eng. Chem.*, **30**, 765 (1938).

[5] Schoenborn, E. M., and Dougherty, W. C., *Trans. Am. Inst. Chem. Engrs.*, **40**, 51 (1944).

[6] Bain, W. A., and Hougen, O. A., *Trans. Am. Inst. Chem. Engrs.*, **40**, 29 (1944).

[7] Baker, T. C., Chilton, T. H., and Vernon, H. C., *Trans. Am. Inst. Chem. Engrs.*, **31**, 296 (1935).

[8] Newton, Wm. M., Mason, J. W., Metcalfe, Brooks, and Summers, C. O., *Petroleum Refiner*, **31**, October, 141 (1952).

[9] Am. Soc. Mech. Engrs., New York, *Fluid Meters Report*, 4th ed. (1937).

[10] McManus, J. J., M.S. Thesis in chemical engineering, Georgia Institute of Technology (1952).

[11] Metcalfe, Brooks, Ph.D. Thesis in chemical engineering, Georgia Institute of Technology, (1952).

Other Distillation Problems

Are you interested in other distillation problems? Check list of PETROLEUM REFINER reprints shown below. They may be had by addressing Gulf Publishing Company, Box 2608, Houston 1, Texas. Specify the reprint BY NUMBER and please send cash with order.

No. 26 "Applied Distillation" by K. E. Coulter, 20 pages, Price 50 cents.
No. 30 "Bubble Trays—Design and Layout" by James A. Davies, 16 pages, price $1.00.
No. 39 "A New Approach to Tray Design" by Aksel C. Eld, 5 pages, price 25 cents.
No. 54 "Fractionating Absorbers in the Petroleum Industry" by J. C. Hannah, 6 pages, price 25 cents.
No. 56 "Distribution Curves—Introduction and Some Special Cases" by W. D. Harbert, 7 pages, price 25 cents.
No. 65 "Pressure Drop Through Bubble Caps" by J. L. Huitt and R. L. Huntington, 14 pages, 25 cents.
No. 95 "How Surface Tension Affects Flooding in Packed Columns" by W. Meese Newton, J. W. Mason and T. Brooks Metcalfe, 3 pages, price 25 cents.
No. 100 "Fractionation Calculations Made Easier and Faster" by E. L. Pennington, F. H. Poettmann and K. H. Hachmuth, 5 pages, price 25 cents.
No. 105 "Nemographs for Vapor-Liquid Equilibrium Calculations" by F. H. Poettmann and R. B. Rice, 4 pages, 25 cents.

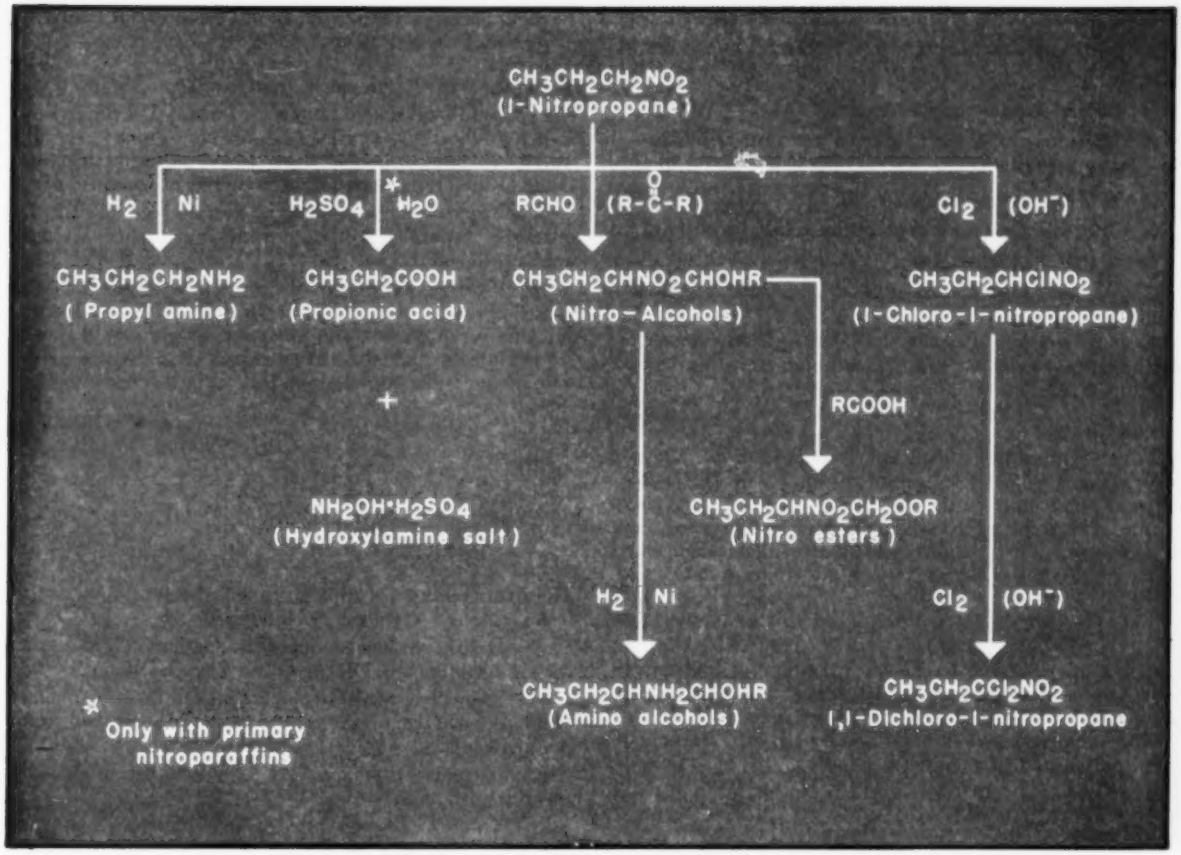


Figure 1. Typical reactions of a nitroparaffin.

Understanding the chemistry of . . .

Petrochemical Reactions

5. Chlorination of Paraffin and Aromatic Hydrocarbons

6. Nitration and Sulfonation of Paraffin and Aromatic Hydrocarbons

7. The Reactions of the Olefins

Lewis F. Hatch, The University of Texas, Austin

WITH THE STUDY of the nitration and sulfonation of petroleum hydrocarbons the discussion of the various reactions used to place functional (reactive) groups on paraffin and aromatic hydrocarbons will be completed. The reactions previously noted (oxidation and chlorination) were characterized, among other ways, by being more widely utilized for the conversion of aromatic compounds than for the conversion of paraffin hydrocarbons. The same generalization applies for nitration with only one company, Commercial Solvents Corporation, nitrating a paraffin hydrocarbon (propane). The nitration of aromatic hydrocarbons, on the other hand, is one of the most important reactions used to place a functional group on the benzene ring.

$$\textit{Nitration}\quad R-H + HNO_3 \rightarrow R-NO_2 + H_2O$$
$$\textit{Sulfonation}\quad R-H + H_2SO_4 \rightarrow R-SO_3H + H_2O$$

The sulfonation of benzene and its homologues is also a widely used reaction in the synthesis of many different industrial products. Sulfonation of paraffin hydrocarbons to produce specific compounds is not at present of commercial importance, although certain petroleum fractions are sulfonated to yield material used as surface active

THE FOLLOWING process variables are of importance in the nitration of aromatic hydrocarbons:

(1) Sulfuric acid concentration.

(2) The amount of sulfuric acid per unit of hydrocarbon.

(3) The amount of excess acid.

(4) The reaction temperature and (5) the time of reaction.

---

agents. Aromatic sulfonates are used as detergents, in synthesis, especially of phenols, and both as dyes and dye intermediates.

Nitration

Nitration may be defined as a process for introducing nitro groups (—NO_2) or nitrate groups (—O—NO_2) into organic compounds by the use of nitric acid or its equivalent. In a more restricted sense, nitration is concerned with nitro groups where the nitrogen atom is attached directly to a carbon atom. A nitrate group with its carbon-oxygen-nitrogen linkage (—C—O—NO_2) is actually an ester with a distinctly different mode of formation and chemical reactions. The current article will be concerned only with the formation and properties of *nitro* compounds.

Nitroparaffins were first synthesized in 1872 from an alkyl halide and silver nitrite.

$$CH_3CH_2Br + AgNO_2 \rightarrow CH_3CH_2NO_2 + AgBr$$

Ethyl bromide — Nitroethane

The versatility of nitroparaffins in the synthesis of other compounds was at once recognized, but commercial utilization was not feasible due to their high cost. It was not until the discovery of high temperature vapor phase nitration of paraffins in 1934 at Purdue University that a relatively inexpensive source of nitroparaffins was available. The situation prior to that time was summarized in 1928 by the statement that "the nitration of paraffin fractions has been studied to some extent but no results of either scientific or technical importance have been obtained because of the mixed nature of the fractions and the complexity of the reactions." The first tank car of nitroparaffins left the plant of Commercial Solvents Corporation in 1941.

TABLE 1

Products from the Nitration of Paraffin Hydrocarbon Between 400-450 C.

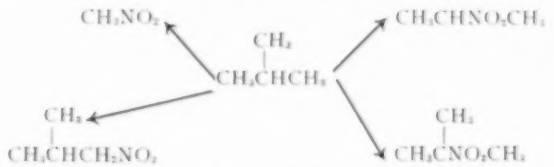
Hydrocarbon	PRODUCTS		
	Name	Formula	Percent
Methane (CH_4)	Nitromethane	CH_3NO_2	100
Ethane (CH_3CH_3)	Nitromethane		27
	Nitroethane	$CH_3CH_2NO_2$	73
Propane ($CH_3CH_2CH_3$)	Nitromethane		9
	Nitroethane		26
	1-Nitropropane	$CH_3CH_2CH_2NO_2$	32
	2-Nitropropane	$CH_3CHNO_2CH_3$	33
Butane ($CH_3CH_2CH_2CH_3$)	Nitromethane		11
	Nitroethane		16
	1-Nitropropane		5
	1-Nitrobutane	$CH_3CH_2CH_2CH_2NO_2$	24
	2-Nitrobutane	$CH_3CHNO_2CH_2CH_3$	44
Isobutane CH_3 / CH_3-CH-CH_3	Nitromethane		6
	2-Nitropropane	CH_3 / CH_3-CH-NO_2	23
	2-Methyl-2-nitropropane	CH_3 / CH_3-C-NO_2 / CH_3	7
	2-Methyl-1-nitropropane	CH_3 / CH_3-CH-CH_2NO_2	64

What Are the General Rules for Nitration?

As a result of investigations at Purdue University and in many other laboratories it is possible to make generalizations pertaining to the vapor phase nitration reaction. Some of the more pertinent of these generalizations are:

(1) If pyrolytic temperatures are avoided during the nitration of paraffins or naphthenes, no carbon skeleton rearrangements occur.

(2) When a paraffin hydrocarbon is nitrated in the vapor phase at high temperatures, all of the mononitro substitution products are obtained which would result from replacing any hydrogen atoms in the hydrocarbon or reacting with any alkyl radical from the hydrocarbon.



The hydrogen atoms are substituted at rates which are in order primary < secondary < tertiary.

(3) Highly branched paraffins undergo less fission during nitration than do their less branched isomers.

(4) Simple paraffins or naphthenes in the vapor phase yield products containing not more than one nitro group per molecule.

(5) Nitrogen dioxide (NO_2) and nitric acid yield identical products.

(6) Total yields of nitro compounds do not vary greatly if exposure time and reaction temperature are carefully matched.

(7) Elevated pressures increase the reaction rate and the difficulty of temperature control without greatly increasing the yields.

(8) Oxidation accompanies nitration.

(9) Catalysts accelerate oxidation rather than nitration.

Vapor-phase nitration of aliphatic hydrocarbons is considered to be a free-radical process. The nitrating agent is the NO_2* radical ($HNO_3 \rightarrow OH^* + NO_2^*$). Two reaction mechanisms have been proposed to explain the formation of nitrated fission products during vapor-phase nitration of paraffin hydrocarbons. One theory assumes that nitration is intimately related to oxidation of the hydrocarbon and results in the formation of alkoxy radicals ($R—O_i^*$), decomposition of which leads to lower alkyl radicals and carboxyl compounds. Subsequent reactions of the lower alkyl radicals with the nitrating agents yield the corresponding nitroparaffins. The other proposed mechanism postulates the replacement of alkyl groups occurring by bimolecular reaction of a hydrocarbon with nitric acid with the resulting formation of lower nitro compounds and alcohols.

Nitration of Paraffins

Propane is nitrated commercially at about 420 C. in a pyrex-glass or fused-silica lined stainless steel reactor at a pressure of about 100 psi. The nitric acid is introduced into the reactor from several nozzles to give a hydrocarbon-nitric acid ratio of 25 to 1 at any one stage with an overall ratio of approximately 5 to 1. The yield on propane is probably in the order of 25 to 30 percent. The principal by-products are aldehydes and ketones with some acids, alcohols, carbon dioxide, olefins and water.

Dinitroparaffins are not formed during this type of

nitration. They can be produced, however, either by nitrating a mononitroparaffin or adding nitrogen tetroxide (N_2O_4) to an olefin.

$$\underset{\text{Butene-2}}{CH_3CH=CHCH_3} + N_2O_4 \rightarrow \underset{\text{2,3-Dinitrobutane}}{CH_3CHNO_2CHNO_2CH_3}$$

Liquid phase nitration of paraffin hydrocarbons results in appreciable oxidation and the formation of polynitro compounds. By this method of nitration, isobutane can be nitrated at 150 C. to give a 99 percent yield of 2-methyl-2-nitropropane.

$$\underset{\text{Isobutane}}{\begin{matrix}CH_3\\|\\CH_3CHCH_3\end{matrix}} + HNO_3 \rightarrow \underset{\text{2-Methyl-2-nitropropane}}{\begin{matrix}CH_3\\|\\CH_3CNO_2CH_3\end{matrix}} + H_2O$$

Liquid phase nitration of paraffin hydrocarbons is not used commercially.

The nitroparaffins are used both as medium boiling solvents (nitromethane b.p. 101 C.) and for the synthesis of other compounds. Figure 1 gives some of the more important reactions of the nitroparaffins.

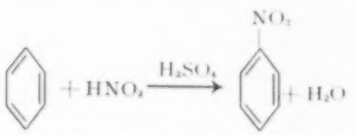
TABLE 2

Products from the Nitration of Aromatic Hydrocarbons Between 15-40° C.

Hydrocarbon	PRODUCTS		
	Name	Formula	Percent
Benzene	Nitrobenzene		100
Toluene			
	o-Nitrotoluene		58.5
	m-Nitrotoluene		4.4
	p-Nitrotoluene		37.1
Cumene		CH_3-CH-CH_3	
	o-Nitrocumene		24
	p-Nitrocumene		76
tert-butylbenzene		CH_3 CH_3-C-CH_3	
	o-Nitro-tert-butylbenzene		15.8
	m-Nitro-tert-butylbenzene		11.5
	p-Nitro-tert-butylbenzene		72.7

Nitration of Aromatics

The nitration of aromatic hydrocarbons differs from that of paraffin hydrocarbons in the simplicity of the reaction and the extent to which the reaction is carried out by industry. For example, benzene is nitrated at 50 to 55 C. to give a 95 to 98 percent yield of the mononitro product (nitrobenzene) with essentially no oxidation or fission.



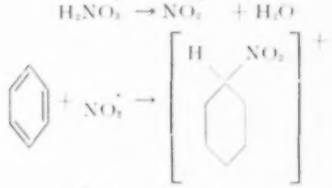
Other outstanding features of the reaction are the low temperature and the use of sulfuric acid.

The role played by sulfuric acid in this reaction is very important but somewhat obscure. It was first thought that the sulfuric acid merely acted as a dehydrating agent to shift the equilibrium of the nitration reaction to the right by tying up the water molecules. It is now known that the reaction is irreversible, and it is believed that the sulfuric acid acts only as a strong proton donor ionizing solvent. The following equations represent the current mechanism for the reaction.

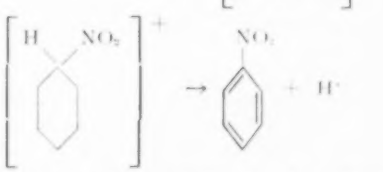
$$2HNO_3 \rightarrow H_2NO_3^+ + NO_3^- \qquad \text{Fast}$$

$$HNO_3 + H_2SO_4 \rightarrow H_2NO_3^+ + HSO_4^- \qquad \text{Fast}$$

$$H_2NO_3^+ \rightarrow NO_2^+ + H_2O \qquad \text{Slow}$$



Slow



Fast

The kinetic data on nitration in sulfuric acid indicate that the reaction is of the second order.

The following process variables are of importance in the nitration of aromatic hydrocarbons: (1) sulfuric acid concentration, (2) the amount of sulfuric acid per unit of hydrocarbon, (3) the amount of excess nitric acid, (4) the reaction temperature and (5) the time of reaction. The nitration of alkylated benzenes presents the added problem of the orientation of the nitro group. The substitution is predominately in the *ortho-para* positions with various factors influencing the ratio of *ortho* to *para*. The most prominent factor seems to be the nature of the alkyl

NITROBENZENE was produced to the extent of 137,995,000 pounds in 1952. About 80 percent of this nitrobenzene was reduced to aniline which in turn was used in dye manufacture.
Nitrobenzene and other nitro compounds are extensively used as raw materials for the dye industry; it is also used to a small extent as a solvent.

group already on the benzene ring. This is shown in Table 2 which gives the percent distribution of some isomeric mononitro alkyl benzenes. These nitrations were carried out under nearly comparable conditions. Apparently the size of the alkyl group offers steric hindrance to substitution in the *ortho* position. Within the usual range of nitration temperatures, temperature does not influence the distribution of isomers (*ortho*, *meta* and *para*).

It is much more difficult to cause dinitration to occur than mononitration. It has been estimated that the second-order rate constant for the mono nitration of toluene is 10 million times that for the mononitration of nitrotoluene. The presence of a nitro group on a benzene ring deactivates the ring toward replacement of its remaining hydrogen atoms.

Nitrobenzene was produced to the extent of 137,995,000 pounds in 1952. About 80 percent of this nitrobenzene was reduced to aniline which in turn was used in dye manufacture. Nitrobenzene and other nitro compounds are extensively used as raw materials for the dye industry; it is also used to a small extent as a solvent. Toluene is nitrated to trinitrotoluene (TNT) and *tert*-butyl-methoxy toluene and similar compounds are nitrated to give substances used as artificial musk. This last fact is of little importance to the petroleum industry but of great concern to an Asiatic deer.

Sulfonation

Sulfonation is the process of introducing the sulfonic acid group ($-SO_3H$) into an organic compound. This type of group and reaction should not be confused with the similar *sulfation* process which involves the sulfate group ($-O-SO_3H$) with its carbon-oxygen-sulfur ester linkage. Sulfonates are, in general, more stable and useful than the organic sulfates (except the higher molecular weight sulfates used as detergents).

Sulfonating Paraffins

Sulfuric acid and sulfur trioxide (SO_3), either alone or in combination (oleum), are the common sulfonating agents, especially for aromatic compounds. The much less reactive paraffin hydrocarbons are sulfonated only under rigorous conditions with resulting sulfonation and oxidation by-products. Within recent years the use of sulfur dioxide and chlorine (or sulfuryl chloride, SO_2Cl_2) for the sulfonation of paraffin hydrocarbons has had considerable research interest, but this reagent has not been used industrially on a large scale because of processing problems.

$$R-H + SO_2 + Cl_2 \rightarrow R-SO_2Cl + HCl$$

An alkyl sulfonyl chloride

$$R-SO_2Cl + 2\,NaOH \rightarrow R-SO_3Na + NaCl + H^2O$$

A sodium alkyl sulfonate

Chlorosulfonic acid ($Cl-SO_3H$) will react with both paraffin and aromatic hydrocarbons.

$$R-H + Cl-SO_3H \rightarrow R-SO_3H + HCl$$

Alkyl sulfonates may also be made by the reaction between an organic halide and alkali sulfites (Strecker reaction).

$$R-X + Na_2SO_3 \xrightarrow{200^\circ C.} R-SO_3Na + NaX$$

This reaction is not satisfactory for most secondary and tertiary halides but furnishes a good method for the production of primary sulfonates provided, of course, the primary halides are available.

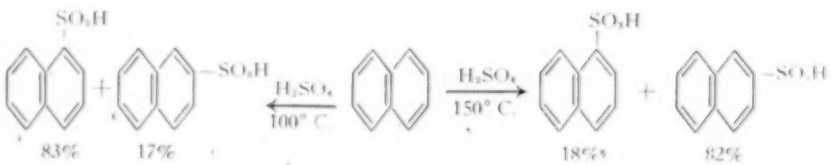
The only important sulfonation of paraffin hydrocarbons is the production of surface active agents from petroleum fraction in the kerosine range. Sulfuric acid does not react with paraffin hydrocarbons, so oleum is used; and probably at least part of the sulfonation is on aromatic compounds in the petroleum fraction.

Sulfonating Aromatics

Benzene is readily sulfonated with sulfuric acid, oleum or free sulfur trioxide. A typical sulfonation would use 98 percent sulfuric acid at a temperature of 80 to 100 C. to give a 98 percent yield of benzenesulfonic acid. Disulfonation requires temperatures in the range of 220 to 260 C. Cast iron equipment is used for acid concentrations between 88 and 98 percent. Steel is used for oleum and free sulfur trioxide.

In the sulfonation of toluene all three isomers (*ortho*, *meta*, *para*) are formed, and the ratio of *ortho* to *para* isomers can be changed by temperature. At 35 C. the ratio of *ortha*, *meta*, *para* is 32:6:62, while at 100 C. the ratio is 13:3:79. The influence of temperature on isomer ratio is even more pronounced with naphthalene.

Sulfonation of alkylaryl compounds has become a major industrial reaction, because the resulting sulfonates are the most widely used type of synthetic detergent.



There are several reasons for their pre-eminence in the field, with the low cost and ready availability of the raw material being of primary importance. The alkyl benzenes and naphthalenes are derived from keryl chlorides (chlorinated kerosine fractions), propylene polymer (C_{12}) or C_{10} to C_{14} olefins by the usual alkylation methods. The sulfonic acid group is on the aromatic ring and probably in the *para* position.

The other large use of aromatic sulfonates is in the synthesis of intermediates for dyestuffs. The sulfonic acid group is readily replaced by other groups such as hydroxyl ($-OH$), nitro, amino ($-NH_2$) and halogen. This property permits the synthesis of many compounds obtainable by other methods only with greater difficulty. In dyes the sulfonic acid group both acts as an auxochrome group and increases the solubility of the dye.

Benzenesulfonic acid is used to make phenol, and other sulfonic acids are used to make as widely different compounds as saccharin and chloramin-T.

End of Part 6. Part 7 will appear in an early issue.

How to Specify Pumps

Melvin Mann,
Peerless Pump Division, Food Machinery and Chemical Corporation, Los Angeles

CORRECT PUMP selection is of vital importance to the manufacturer, customer and salesman. A high degree of cooperation is essential to the selection of the optimum pump for a given application. The purpose of this article is to highlight the critical factors, from the manufacturers' standpoint, in the selection of pumps. Only with complete information can the manufacturer properly analyze the problems and ultimately make the best possible selection for a given situation.

When suggesting a pump, it is the desire of the manufacturer's proposal department to offer the optimum unit, design-wise and performance-wise, consistent with the practical and economic factors which enter into the selection. For example, the optimum selection from the application standpoint might be a six-pole or eight-pole pump speed, but for reasons of initial price, perhaps a four-pole pump would be most satisfactory.

Here it is important for the buyer to give the proposal section an idea as to what is his predominant thinking. This is also the opportunity for the salesman to point out the advantages of the optimum unit when long-range economic factors of operational efficiency and lowered maintenance costs (due to lower speeds for example) are apparent. If, however, first price alone is the primary consideration in the mind of the customer, this should be clearly set forth to the proposal section so it will not spend unnecessary time on the other selection factors, which would ordinarily be regarded as important.

On many requests for quotations, all the important conditions are not described. This obviously results in delay in the quotation, and what is more important, can be directly responsible for future operational trouble, due to mis-application. Preliminary information which is complete in all its details is most necessary. This is especially true where the liquid to be handled is other than water.

Fluid Characteristics

The following fluid characteristics should be carefully determined and submitted to the proposal department of the pump manufacturer:

(a) *Commercial designation* and if possible, chemical designation of the liquid.

(b) *Concentration of liquid* expressed either in terms of its absolute chemical concentration or perhaps in some commercial scale such as Baume or specific gravity.

(c) *Vapor Pressure* of the liquid. It is important that this be determined at the outset and agreed upon for the particular conditions. When in doubt about the vapor pressure, particular precautions are suggested. A corollary of this is the determination of the available NPSH in the system.

(d) *Pumping temperature* should be clearly stated; if it is over a range of temperatures, the maximum and minimum temperatures should be specified.

(e) *The viscosity* at the pumping temperature. This should be stated clearly in conventional terms of some accepted standard visosity scale.

(f) *PH or other chemical properties* which are known or can be presumed (on the part of the customer) to prevail. For example, in some chemical solutions, "impurities," a very vague term, generally leave the ultimate properties of the solution an unknown factor to the Proposal Section. If the "impurities" constitute only a minute part of the solution, then it should be determined whether these minute percentages will have an effect on the pumping conditions. Furthermore, the basic nature of solids in suspension should be described if possible. For instance, some solids in suspension have very little abrasive quality (such as talc) while others (such as silica compounds) even though in small quantities, would have damaging effects on pumping and piping equipment.

(g) Finally, the customer frequently knows from his own experience what *materials* are *best suited* for the job under consideration. His counsel should be relied upon to a great extent.

It is not good practice to rely solely on the nomenclature of an individual industry. For example, "fuel oil No. 5" may mean a great deal to a refinery man in a given area. "Fuel oil No. 5" may mean quite a different thing to some other oil company. If all terms are not properly defined, the manufacturer cannot always be expected to make the best selection for the conditions.

All too frequently, from preliminary information received by the pump manufacturer, it could be assumed that the head-capacity relationship is for a fixed point only. This is virtually never the case in actual operation; particularly in industrial applications. Normal percentages of error in figuring system head losses due to friction, elbows, bends and variations in capacity, greatly influence the operating conditions to which the pump will be subjected. Therefore, it is well to gather and submit as much information as possible regarding probable variations in head, and capacity. If desired, and given sufficient information, the proposal section will plot the system head curve on request. This helps to further define the operating conditions, for the protection of the customer and to give the best service possible by the pump manufacturer.

External factors frequently restrict the applicable safety factors to minimum limits. Therefore, it is not unusual to find adverse conditions, after the pump is finally installed and put on stream. The most frequent mani-

MAINTENANCE / OPERATION

CUSTOMER SPECIFICATION DATA SHEET

(a) Service _____ (b) Pump Type: _____

(c) Recommended Speed: _____ rpm (d) No. of Units req'd: _____

(e) Liquid: _____ Differential head _____ feet

(f) Hydraulic Requirements: Suction pressure at pump _____ psig

Pumping Temperature (P.T.) _____ F. Height of liquid on bottom of pit _____ feet

Design GPM @ P.T. _____ Discharge pressure at pump _____ psig

Specific Gravity @ P.T. _____ NPSH Available _____ feet

Viscosity @ P.T. _____ SSU Altitude above sea level _____ feet

Vapor Pressure @ P.T. _____ psia

Describe hydraulic conditions under which pump may be operated at other than design capacity and head such as throttling to a reduced capacity, lower suction or discharge head than stated above, et cetera.

(g) Material:

Are abrasives and/or corrosive agents present in liquid to the extent that special design and materials are indicated?

Yes _____ No _____

If yes, describe, if possible, under "Remarks" or state below the material recommendations of major parts such as:

Volute _____ Shaft Sleeve _____

Impeller _____ Column (if vertical type) _____

Wear Rings _____ Bearings (if vertical type) _____

Shaft _____ Discharge head (if vertical type) _____

(h) Construction Features:

Packing
Mechanical seal
Jacketed stuffing box
Plain stuffing box
Flushed box thru lantern ring

Water cooled bearings (if horizontal type)
Standard coupling
Spacer coupling

Volute wear rings
Impeller wear rings
Flushed wear rings
Coupling guards (if horiz. type)
Depth of pit or setting (if vert. type)

(i) Type of Driver:

MOTOR

Type _____
Special Insulation _____
Volts _____
Phase _____
Cycle _____
Bearings _____
Bearing Lubrication _____

STEAM TURBINE

Type _____
Inlet pressure _____ psig
Back pressure _____ psig
Inlet temperature _____ F.
Dry or saturated _____

OTHER

(j) Tests:

Performance test required: _____ Hydrostatic test required: _____

Non-witness _____ Non-witness _____

Witness _____ Witness _____

(k) Remarks: _____

Figure 1. Ideal specification data sheet.

festations of this are: (a) motor overload on centrifugal pumps where the actual operating head is considerably lower than the pump was designed for. (b) Bearing trouble on close-coupled turbine-type pumps operating at heads much lower than the design head, so that a continuous up-thrust load prevails. On all application problems involving close-coupled vertical turbine pumps (50 feet or less) particular attention should be given to the operating conditions that are likely to prevail in service. (c) Cavitation, erosion and eventual destruction of pumps due to operation at heads lower than specified and thus capacities greater than specified.

One of the frequent erroneous assumptions made is the "flooded suction" assumption. What is flooded suction? It may mean that the suction has a head of one hundred feet or more on it, if not otherwise defined. "Flooded suction" is a meaningless term by itself and it behooves all to acquaint themselves with the facts relating to suction conditions. This is equally true whether the liquid is water, hydrocarbon compound or complex chemical compounds with many high-capacity vertical turbine pumps and all mixed flow pumps, marked increases in heads over the design head can result in operation at an undersirable spot or dip in the head-capacity curve. This results in a severe loss of performance for both types of pumps, as well as an appreciable increase in horsepower. This is particularly true in the case of mixed-flow and axial-flow pumps.

Figure 1 presents the author's views of an ideal specification sheet.

By way of summary, for the best application it is necessary to completely define—insofar as possible—the head-capacity ranges which are likely to be encountered, particularly where complex systems are involved. All available information on the physical and chemical characteristics of the liquid should be submitted. Consideration should be given to the most adverse circumstances under which the system could possibly operate. For example, is there a possibility that the system could be completely isolated by closing valves on both sides of the pump operation? If this is a possibility, it should be pointed out in the preliminary information.

Finally, field experience and observations as to materials used in pumping equipment for various chemical solutions should be recorded. This will help both the customer and the proposal department in recommending the proper equipment for similar problems encountered elsewhere.

MAINTENANCE / OPERATION

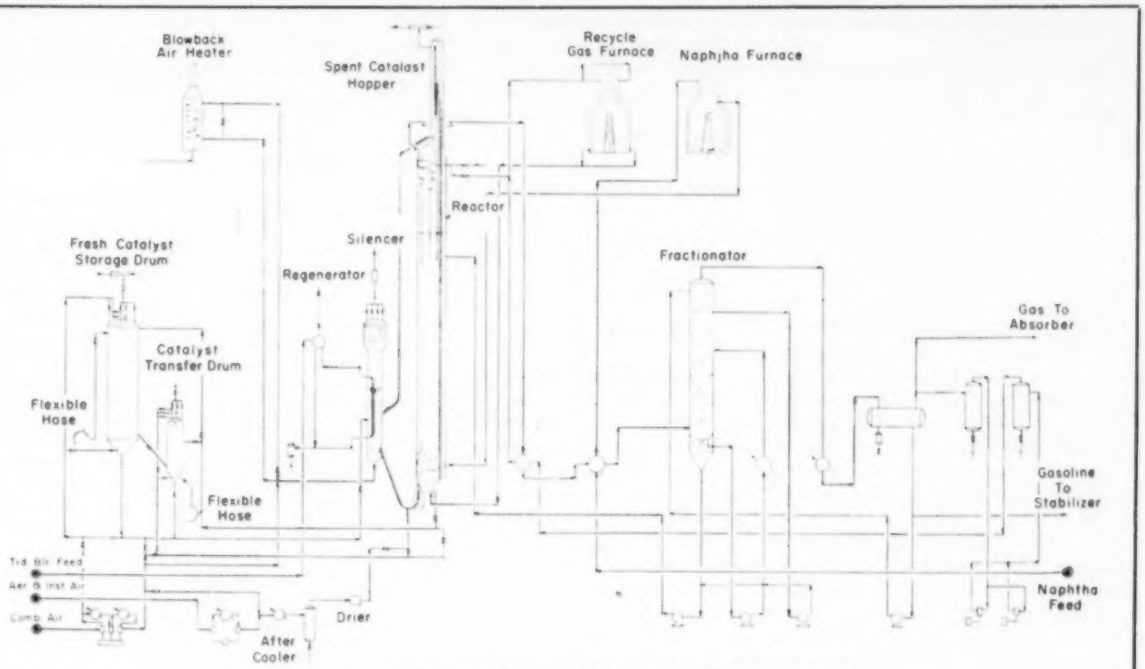


Figure 1. Flow diagram of Fluid Catalytic Hydroforming unit.

The Mechanical Design of . . .

Fluid Catalytic Hydroforming Units

Valuable experience gained from the design of the first commercial application of this new process is carefully analyzed and reported.

R. A. Harang, The M. W. Kellogg Company, New York

ONE OF THE most recently announced catalytic reforming processes—Fluid Catalytic Hydroforming—utilizes the fluid catalyst technique. This highly successful system has been applied to the long established Hydroforming process to provide a modern and unique method for upgrading low-quality naphthas. This article analyzes the mechanical engineering design features of the new process, and is based on the experience realized from the installation of the first commercial Fluid Hydroforming unit installed at Destrehan, La., for the Pan-Am Southern Corporation.

Process Description—In the hydroforming process, straight run naphtha of low octane number is converted into high octane gasoline by contacting the naphtha with a catalyst at suitable pressure and temperature conditions and in the presence of hydrogen in relatively high concentration. The hydrogen is produced in the process and the concentration is maintained by recycling to the reactor, a gas stream rich in hydrogen. The design process conditions are shown in Table 1.

A simplified flow sheet for the Destrehan Fluid Catalytic Hydroforming unit is shown in Figure 1. The vaporized naphtha charge is injected into a bed of fluidized powdered catalyst in the bottom of the vessel, while recycle gas enters the bottom and passes through an internal distributor.

TABLE 1

REACTOR:	
Operating Pressure	250 psig
Operating Temperature	920 psig
Naphtha Feed Temperature	930 F.
Recycle Gas Temperature	1300 F.
Regenerated Catalyst Temperature	1100 F.
SPENT CATALYST HOPPER:	
Operating Pressure	250 psig
Operating Temperature	910 F.
REGENERATOR:	
Operating Pressure	260 psig
Operating Temperature	1100 F.
Bed Cooler Pressure	250 psig
Bed Cooler Temperature	406 F.
Combustion Air Temperature	290 F.
Spent Catalyst Temperature	910 F.

The upward flow of vapor through the catalyst bed keeps the bed in a fluidized state. Near the top of the bed, a stream of catalyst bearing slurry oil from the bottom of the fractionator may be returned to the reactor. This oil is quickly vaporized at the temperatures existing within the vessel.

The vapor flowing upward from the surface of the bed carries a certain amount of catalyst with it. Most of the entrained catalyst settles out in the disengaging space above the bed. The vapor then enters cyclone separators where most of the remaining catalyst

MAINTENANCE / OPERATION

is recovered before the vapor passes to the fractionator.

Spent catalyst is withdrawn from the lower part of the reactor bed into an internal riser pipe and lifted to the stripper section above the reactor in a stream of recycle gas. The rate of catalyst withdrawal is controlled by the opening of a plug valve at the inlet end of the riser. The carrier gas enters the riser line through the hollow stem of the valve.

Spent catalyst is separated from the carrier gas in the stripper hopper which is vented to the top of the reactor. Steam is used to strip hydrocarbons from the spent catalyst which otherwise would be carried to the regenerator and burned. The steam and stripped vapor flows up through the hopper bed and passes into the reactor via the vent pipe. The stripped catalyst then flows by gravity through a standpipe which conveys it to the regenerator at a rate which is governed by a slide valve in the line.

Coke is deposited on the catalyst as a product of the hydroforming reaction and is burned off in the regenerator. The combustion air enters the regenerator through an internal distributing grid. A portion of the heat generated by the combustion of coke is utilized to make steam in vertical boiler tubes placed in the regenerator bed.

The flue gas passes through a disengaging space above the bed where some of the entrained catalyst settles out, additional entrained catalyst is removed from the gas by cyclone separators or filters arranged in the top of the regenerator. The flue gas from the filter outlets then passes through an automatic valve and manual valves to reduce pressure and thence through a silencer to the atmosphere.

Regenerated catalyst flows by gravity from the lower part of the regenerator bed through a standpipe into the bottom of the reactor. This flow rate is regulated by a valve which automatically controls the level in the regenerator.

The reactor overhead vapor is cooled before entering the fractionator tower by heat exchange with recycle gas and fresh naphtha. The relatively heavy fractions are condensed out by a heavy oil reflux in the lower baffled section of the tower which also scrubs out the entrained catalyst which flows to the bottom slurry settling section of the tower. Thickened slurry of catalyst in oil is taken from the bottom of the settler and pumped to the reactor to return the catalyst to the system.

The fractionator overhead vapor is partially condensed and the resulting gas and liquid separated in a reflux drum. A portion of the condensate is returned to the tower as top reflux while the net product flows to the stabilizing section under its own pressure. A portion of the uncondensed gas is used as recycle, bleed, and carrier gas. The net gas make flows to an absorber in which the heavier ends are removed by contact with fresh naphtha feed.

Regenerator Vessel—The regenerator is constructed to meet the requirements of the ASME Unfired Pressure Vessel Code, with a joint efficiency of 95 percent corresponding to x-rayed and stress relieved construction. Figure 2 is a schematic drawing of the Destrehan Regenerator. The lower section is 2 feet-11 inches i.d. of steel while the upper section is enlarged to six feet i.d. of steel to house the filter or cyclone assemblies. It is lined with insulating and refractory concrete in order to reduce the metal temperature.

The vertical tube waste heat boiler in the lower section of the regenerator meets the requirements of the ASME Power Boiler Code. The tubes were installed in the field after the vessel was erected and the entire steam generating system was hydrostatically tested after construction.

The materials of construction are carbon steel throughout with the exception of internal piping and tubes for which it is economical to use low alloy steel for structural considerations.

The filter assemblies were designed for use of ceramic or metallic filters. With metallic filters, an adapter piece is used to handle two metallic filters in order to provide the same filter area as that available with the ceramic filters. The filters are arranged in four banks of four filters each, giving a total of 16 filter elements. Each bank of filters has an inlidivual outlet line which passes through the top head of the regenerator and is provided with an automatic blow-back valve on time cycle control. The four outlets are joined outside of the vessel into a common flue gas stack.

Regenerator Bed Cooler—The regenerator bed temperature is controlled by means of a series of vertical boiler tubes, partially submerged in the bed. The feed water for this cooler is supplied from a steam separator drum by gravity flow and the rate of circulation is based on the thermal siphon effect of the steam generated. The catalyst bed level is adjusted to control the amount of tube surface in contact with the bed depending on the desired generator temperature. The steam generated in this waste heat boiler is sent to the unit high pressure steam system.

Regenerator Vent System—The design requirements of this regenerator vent system differs from that of a conventional cracking unit in that it is necessary to dissipate 250 pounds across the control valves and stack. It was felt that with the installation of filters for the removal of catalyst from the flue gas stream, the problem of erosion would be negligible Due to this factor, standard valves were used in the vent system to control the pressure on the regenerator and to dissipate the differential between the regenerator operating pressure and atmosphere.

Two alternate control valves are provided so that a spare will be available if the working valve should become eroded by catalyst in the event of filter failure. Downstream of the control valves are two hand operated globe valves in series, which are intended for throttling to reduce a large part of the total flue gas pressure. A surge drum is located between the automatic and manual valves to dampen pressure fluctuations. A silencer was also used in this system to reduce the noise level. On the larger units now under design and construction, the filter assemblies are replaced by conventional cyclones for dust recovery. In such a design, there will be catalyst in the flue gas and, therefore, it is necessary to design the stack control valves for erosive conditions. These valves will be plug type valves, two in series with the valve controlling regenerator pressure, taking a maximum drop of approximately 50 psi and the second valve taking approximately 150 psi. The remainder of the pressure drop will be produced by perforated baffle plates in the stack. Two identical stacks will be installed to allow maintenance on the pressure reducing valves while the unit is in operation.

Filter Blowback System—In order to control the pressure in the regenerator, it is necessary to keep the pressure drop through the filters below a set maximum differential. The pressure drop through each filter increases during its service due to a cake of catalyst building up on the outside and to remove this catalyst, it is necessary to impose an internal pressure on the filter greater than the regenerator pressure to spall the cake off the filter. This is accomplished by

MAINTENANCE / OPERATION

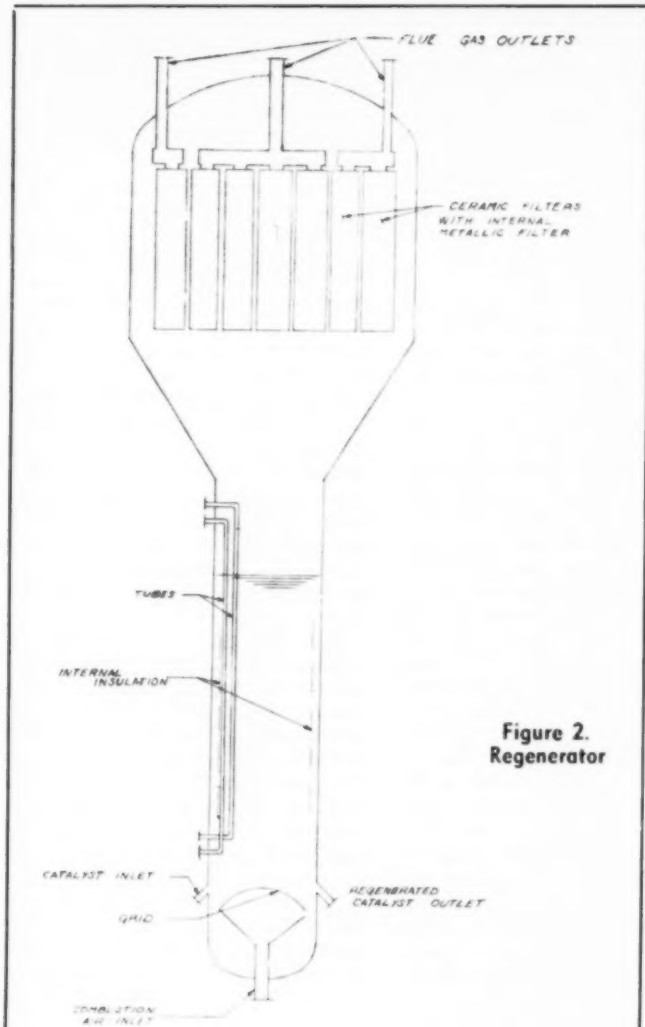


Figure 2. Regenerator

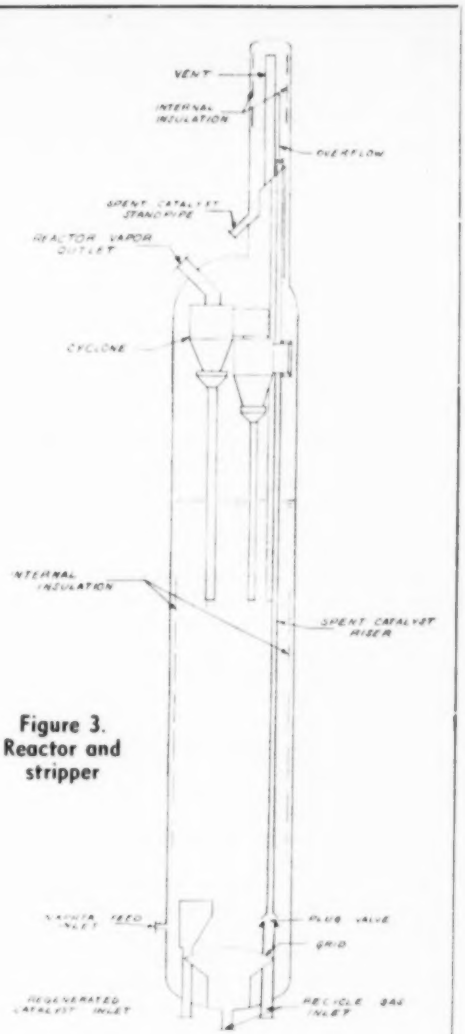


Figure 3. Reactor and stripper

means of the blowback system. The filters are susceptible to thermal shock and, therefore, the air is pre-heated to the same temperature as the flue gas leaving the regenerator. This is accomplished by the use of a small helical coil furnace supplied for this duty.

The blowback is controlled by an automatic time cycle instrument. The instrument is furnished with an adjustable range, so that the cycle may be varied from four to forty minutes. Through operating experience, the length of the blowback cycle can be determined by the pressure build-up across the filter bank and the automatic timer is set to hold the pressure drop below a suitable maximum.

A three-way valve, controls the blowback to each individual filter bank. In one position the valve permits the flue gas to enter the flue gas stack. In the other position it allows the blowback air to enter the filter bank. The valve is actuated by a pneumatically operated cylinder.

Power air is directed to either side of the cylinder by a four-way two-flow pilot valve which is a snap action mechanism actuated by a spring loaded pneumatic diaphragm. The movement of the diaphragm is controlled through another three-way valve in the cycle timer.

A complete cycle is finished when each of the four banks has been on the blowback service.

Reactor Vessel—The reactor has been designed to meet the requirements of the API-ASME Code. This vessel has a joint efficiency of 95 percent as it is x-rayed and stress relieved. The Destrehan Reactor shown in Figure 3 is 7 feet 1 inch i.d. of steel and, therefore, was completely shop fabricated. In the largest unit under construction this vessel is 20 feet i.d. of steel and must be field erected. The stress relieving will be done after erection, posing an additional construction problem.

The design metal temperature is lower than the working flow temperature as the vessel is lined to reduce the metal temperature. This lining is five inches thick and consists of four inches of insulating concrete and one inch of refractory concrete reinforced with hex steel secured to the shell by Nelson studs. This installation is similar to that used in catalytic cracking vessels.

The vessel is constructed of carbon steel including cyclones, braces and clips. The grid is constructed of 18-8 chrome, nickel steel, and internal pip-

MAINTENANCE / OPERATION

ing of A106, Grade "A," seamless steel.

The spent catalyst hopper which is placed eccentric to the center of the reactor vessel, is constructed to API-ASME Code and has a joint efficiency of 80 percent. This section was installed in the field. It is sealed from the reactor section by an internal pipe sleeve welded to a cone extending from the reactor shell. It is also internally lined in the same manner as the reactor in order to reduce the metal temperature and is constructed entirely of carbon steel.

Reactor Cyclones—One set of two-stage cyclones have been installed in the reactor to remove the entrained catalyst in the reactor effluent stream. These are conventional unlined cyclones which have an expected recovery efficiency of 99 percent.

Reactor Feed Distributor—The feed to the reactor consisted of recycle gas and naphtha. These two constituents must be brought in intimate contact in the bed of catalyst in order to produce the desired reaction. Due to the elevated temperature of the recycle gas stream, it is undesirable to have the gas and naphtha in contact without the presence of the catalyst for an appreciable period of time, as thermal cracking of the naphtha may result. In a small unit such as the one now in operation, it is a relatively simple matter to inject the naphtha into the catalyst bed at a number of points around the periphery of the bed and obtain satisfactory distribution across the bed. The recycle gas is brought in under a perforated grid at the bottom head and in this manner evenly distributed. As the diameter of the reactor increases, the problem of uniform distribution of both recycle gas and naphtha throughout the entire bed becomes more difficult. It has been proposed to mix the recycle gas and naphtha at the nozzle in the bottom head and distribute it across the bed by means of a multi-armed distributor. The volume of this distributor would be kept to a minimum in order to decrease the residence time and thus decrease the amount of thermal cracking of the naphtha feed. Another proposal covers injection of naphtha under a grid through a central riser pipe with the recycle gas entering through the annular space. The latter method permits the recycle gas to pick-up catalyst before coming in contact with the naphtha and thus reduces possibility of thermal cracking.

Catalyst Storage and Transfer Drums—The catalyst storage drum is designed for the combined inventory of the catalyst process vessels. On the larger units, two storage drums are provided; one drum to contain the fresh catalyst and the other to receive the unit inventory when the process vessels are emptied during shutdown. The storage drums are designed for low pressure and a maximum temperature of 650 F.

The storage drum is provided with two parallel sets of porous metal filters. These filters are installed to prevent catalyst loss by entrainment during loading and unloading operations. There are blowback lines to each filter to clear the elements of the filter cake.

The operating conditions of the unit are such that a catalyst transfer drum is required to make catalyst additions during operations and to withdraw catalyst from the system. The drum is designed for an operating pressure above 250 psig and a temperature of 1000 F. It is internally lined with 4½ inches of insulating and refractory concrete to reduce the design metal temperature to 650 F. The joint efficiency is 85 percent as the vessel has been stress relieved.

Two metallic filter elements are installed in the top head to eliminate catalyst loss by entrainment while loading or depressurizing. These filters are designed for manual blowback.

Catalyst Slide Valves—Catalyst flow in the spent and regenerated catalyst transfer lines is controlled by slide valves. The valves are conventional plug valves which have been modified to admit air or bleed gas to the valve body inboard of the packing chamber to prevent catalyst from entering. The amount of bleed is controlled by a restriction orifice in order to prevent the erosion of the valve stem.

The valve movement is regulated by a positioning device. The air pressure signal from the primary control instrument, an index of valve position, and operating air at reduced pressure are fed into the positioner. The valve position is registered by means of a metallic tape fastened to an arm on the valve stem and the motion is transmitted to the positioner by the tape through a cam and cam follower which registers in the "control" device.

The positioner through an auxiliary pilot directs high pressure air to the forward or reverse ports of a pneumatic motor which is a piston type rotary motor capable of movement in either direction.

The motion is transmitted to the valve stem through a limitorque gear train. This mechanism is equipped with two limit switch devices to prevent excess torque in either direction. The valve closing limit switch trips a poppet valve that shuts off the power air to the driving motor. The other limiting device working through a mechanical linkage from the gear train trips a second poppet valve, shutting off the air to the motor. Both poppet valves are automatically reset by movement of the motor in the reverse direction.

These valves may be moved manually by means of a handwheel engaged by a clutch lever. The clutch is automatically disengaged by movement of the air motor.

Bleed and Aeration Mediums—The problem of bleed and aeration mediums on a hydroformer is much greater than on a catalytic cracking unit due to the nature of the process. In the hydroformer unit, the vapor in the reaction section consists in the most part of hydrogen gas and the gas in the regeneration section contains oxygen.

It is, therefore, important that the proper bleed mediums in the various parts of the system be chosen to minimize the hazards of combustion. The choice of bleed and aeration medium on the vessels presents no problem. On the reactor hot recycle gas from the discharge of the gas compressor can be employed. Bleed and aeration on the regenerator can be taken directly off the discharge of the combustion air compressor. Choice of bleed and aeration medium for the two transfer lines create quite a different problem. The original design called for recycle gas as aeration on the reactor side of the regenerated and spent catalyst valves. Air was specified for the regenerator side of these valves. Experience on the hydroformer now in operation showed that a reversal of flow in either of the two lines results in combustion of bleed gas. The re-design of these systems has changed the bleed medium to an inert gas and the aeration medium to steam. In addition to this change in bleed gas, the unit was also equipped with remote operated shut-off valves at the reactor and regenerator which are actuated by a loss in differential across a slide valve to further prevent a back flow of gas through the line. The use of steam for the instrument bleeds was considered and dismissed due to a probability of mudding-up the catalyst at these points which would render the instruments inoperable. The inert gas used in the operating unit is nitrogen.

BIBLIOGRAPHY

Seebold, J. E., Bertetti, J. W., Snuggs, J. F., and J. A., Petroleum Refiner, **31**, No. 5, 114 (1952).

Shepardson, R. M., Tyson, C. W., and Voorhies, A., Oil Gas J., **51**, No. 2, 110 (1952).

Gunness, R. C., Chem. Eng. Prog., **49**, No. 3, 113 (1953).

MAINTENANCE / OPERATION

Whip Waste Disposal Problems

—CIRCULAR SEPARATORS insure more efficient oil removal
—BIOLOGICAL OXIDATION handles tough phenol problem
—FLUE GAS DISTILLATION effectively neutralizes caustic

Haviland F. Reves,
Detroit, Mich.

STREAM POLLUTION FROM all sources approaches its maximum complexity and gravity in the Great Lakes area, where water supply, sewage, and industrial needs conflict. There are successive and differing requirements by the cities along the lakes—and differing viewpoints not only of half a dozen states but of two sovereign nations. Discussion and various steps have been taken since the treaty of 1909, especially in the past seven years.

Industrial waste and sewage problems, while often considered together, are separate aspects, presenting distinctive individual problems. Sewage problems can be fairly classed as a group, and various effective programs are underway to work toward the optimum requirements. Waste, however, covers a wide range of problems, in type, nature and scope.

Great Lakes Problem

The size and nature of the Great Lake pollution problem may be epitomized by the Lake Huron-Lake Erie section of the international boundary waters (St. Clair River, Lake St. Clair, and Detroit River). Here is located one of the world's heaviest industrial concentrations. The water supply for the Detroit metropolitan area is drawn from Lake St. Clair.

Into these waters, sources within the United States pour daily: 6120 pounds of phenols; 3690 pounds of cyanides; 11,065 pounds of ammonium compounds; 16,280 gallons of oil; and 1,702,000 pounds of suspended solids. The American contribution represents 73 percent of the discharge into these waters, 27 percent coming from Canada. (Figures are based on a 1951 study by the Federal Security Agency.)

Canadian Answers

To meet this situation, some important steps are being taken across the border. In 1948—when costs were much lower than today—the estimated cost of work to be done by Canadian industry was $3 million. Major steps have been taken by two firms in this area, according to A. E. Berry, director of the Sanitary Engineering division of the Ontario Department of Health. The big Hiram Walker Company distillery at Windsor has installed equipment to reduce wastes. And at Sarnia, Imperial Oil, Ltd., has a very extensive program for the reduction and control of oil wastes, with a large part already completed.

Sarnia is located on the east shore of the St. Clair River, just below the mouth of Lake Huron, and is a relatively short distance upstream from the important Detroit water intake point. Imperial is engaged in an important and expensive job of installing new equipment and revising techniques in order to assure a downstream supply of water free from serious pollution. Details have been furnished to the writer by J. L. Huggett, general superintendent of Imperial.

Waste arises in virtually every step in the refinery process, creating an especially intricate problem when the discharge is necessarily into a stream which serves as a water supply. The wastes may be positively injurious, as well as having disagreeable characteristics of taste and odor, and may make the water unattractive for sports purposes, such as swimming or boating. They probably do not constitute a hazard or even serious nuisance to navigation, aside from odor.

Wastes Sources

Wastes in the refinery arise chiefly from four sources:

- Oil in liquid or gaseous form.
- Materials produced in refining.
- Materials produced during refining (as phenol and other acid oils).
- Spent reagents (as caustic and acid).

Each individual problem requires a different approach for solution.

Solution Procedure

Reduction of the volume of water requiring extensive special treatment is a first objective in control. The primary step is to segregate clean waters from the oily and dirty waters. Thus, water from the condensers and other equipment, where the water pressure exceeds the oil pressure, can be separated. The immediate beneficial effect of this step is to allow the use of longer retention times and lower velocities in the separators, thereby facilitating the settling of the water and solids in the separators.

In quantity, from one-half to two-thirds of the entire water in the refinery is diverted to special sewers. These lead to clean water separators, which are used, not as a necessary clean-up, but as a further safety measure. The remaining portion—water containing oil and dirt—passes on the larger separators, in which the oil is allowed to settle, and is then skimmed off for recovery.

The Imperial refinery expanded at a rapid rate, and it became necessary to build new separators to handle the increased volume of water. Marking a relatively new departure in the industry, circular separators were installed, said to be the largest circular units in the world. The diameter of the oily water separator is 110 feet.

The design and operation of the circular separators present some features of special interest. The oily water enters at the bottom of a central distributing column. From this point, it flows at a slow rate toward the outer edge of the separator unit. Because of the unprecedented size of the unit, the water remains in it for approximately 75 minutes. This allows ample time for the oil to rise to the surface, as the water flows slowly across the separator.

At the edge, the oil is skimmed off by a rotating mechanism and swept

into the skimmer pipe, through which it flows down into a sump. Here it is picked up by a pump and pumped into designated tankage, where it is held until ready for recovery by a distillation process.

In the separators, the solids settle to the bottom, being heavier than the water. Rotating scrapers at the bottom of the separator push the solids into a sump located in the base, whence they are pumped to the waste disposal plant, and disposed of by incineration.

The water from the separators, following the removal of oil and solids, passes under a four-foot baffle and over an adjustable weir into a sewer, which carries it to the river. It is expected that the oil content of the water at this point will be satisfactorily below the standard of 15 ppm. set as a goal by the International Joint Commission on the pollution of boundary waters.

Preventive Measures

The objective of preventing the oil from getting into the water in the first place is of course considered preferable to the heavy expenditure of both money and effort necessary to remove it, and steps which may be considered "policing" are being taken where practicable. These include:

- Mechanical seals have been installed on a number of pumps in the refinery. The mechanical seals are considered more effective than the older types of packed seals.
- "Trap inspectors" have been appointed, with the specific duty of watching the separators, and to track down any leaks which occur in the plant.

Imperial was influenced to select the new design of circular separators, in preference to the familiar rectangular type, by four positive advantages of the circular units:

- Continuous skimming of oil and emulsion by a rotating mechanism.
- Continuous elimination of sludge by the rotating bottom scrapers.
- Satisfactory separation to meet a maximum oil content of 15 ppm in the effluent.
- Lower cost of construction for equivalent thruputs and velocities.

Solutions to Other Waste Problems

Phenolic compounds are objectionable, though non-toxic in the concentrations which could reach the river, because they have the characteristic of combining with the chlorine used in drinking water to produce compounds with disagreeable taste and color. Hence, to eliminate any possibility of complaint from communities downstream, the goal of 20 parts of phenol per billion parts of water was set—an almost incredibly low figure.

Phenolic compounds have three sources in the refinery: original low concentrations in crude oil; as a by-product in cracking gas oils for high octane gasoline; and from the refining of lubricating oils. Hence the problem is itself involved.

Lines at the plant used for phenol-treating lubricating oils have all been reset above ground, and the entire area is currently being paved. This will greatly reduce the occurrence of undetected leaks in the phenol plant area—one serious source of pollution of this type in the past.

Planned for construction to further meet the problem is a special plant for the high rate biological oxidation of phenols—a process new to the oil refining industry.

Trickling Filter Used

Initial step in this process is the use of a trickling filter in which cultures of bacteria, previously gradually exposed to increasing doses of phenol, have been growing. A portion of the water will be pumped onto this trickling filter. The bacteria will be fed special nutrients. The temperature and pH of the water will be controlled so that the bacteria will be kept in a healthy condition.

This portion of the water will then pass out through the trickling filter, carrying the healthy bacteria along with it, to join the remainder of the phenolic water. The combined water streams will then pass through an aero-accelerator, where they will be exposed to air and agitation. These conditions are designed so that the bacteria will consume the phenols, converting them to carbon dioxide and water.

Another source of pollution difficulty is the large quantity of caustic used to extract sulphur compounds from gasoline. This has three undesirable characteristics, making it a serious disposal problem. The resulting caustic is toxic, odorous, and causes emulsions in the separators. One method of disposal used in the past has been to neutralize the caustic with sulphuric acid, and burn off the neutral oils produced. This both results in an objectionable odor, and fails to completely extract the undesirable compounds.

A completely new method of caustic neutralization is planned to replace this sulphuric acid method. A bubble tower will be used, with the caustic controlled to enter the middle of the tower and flow countercurrently to a stream of hot flue gas from the catalytic cracking unit. This gas will then bubble up through the caustic, neutralizing and oxidizing most of the undesirable compounds, and stripping out the remainder.

The caustic, which will be odorless and neutral at this stage, will be pumped to the biological oxidation unit for disposal. At the same time, phenolic waters, containing hydrogen sulphide and ammonium compounds, will be stripped in the top half of the tower and then pumped to the biological oxidation unit. The sour flue gas will be burned.

A further major problem is created by the large amount of acid used in the refining of lubricating oils and light fuels. This acid is toxic in high concentrations, and has the further undesirable quality of stabilizing emulsions in the separators. No direct remedy is contemplated, but it is the hope of plant management to eliminate this source of pollution by a change in procedure, eliminating the bulk of acid treating.

As Management Sees It

The long-range position of management on meeting problems of stream pollution was summarized by A. D. McRae of Imperial in 1951 (Sewage and Industrial Wastes, Vol. 23, p. 538)—"Public opinion is of paramount importance and today industry considers itself lucky if it can break even for expenditures on pollution abatement. . . . In comparison, the handling of sanitary sewage is a somewhat simple affair and government agencies and the public will have to be patient while industry works out its own solution."

"PUBLIC opinion is of paramount importance and today **industry considers itself lucky if it can break even for expenditures on pollution abatement.** . . . In comparison, the handling of sanitary sewage is a somewhat simple affair and government agencies and **the public will have to be patient** while industry works out its own solution."

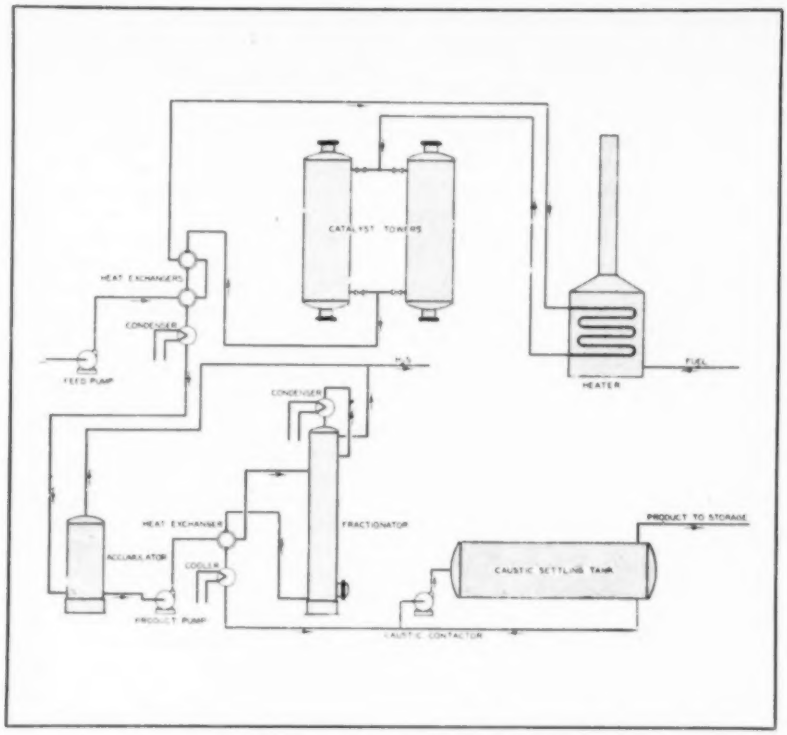


Figure 1. Perco catalytic desulfurization process.

Refining with Adsorbents

Part V.

Vapor-phase refining is an extremely important and widely used adsorbent process for stabilizing and desulfurizing petroleum fractions. Here is the complete story.

V. A. Kalichevsky, Magnolia Petroleum Company, Beaumont, Texas
Kenneth A. Kobe, University of Texas, Austin

VAPOR-PHASE refining with adsorbents is widely used for stabilizing and desulfurizing light petroleum fractions. Catalytic cracking and reforming may be regarded as desulfurizing processes. Previous articles in this series have discussed the manufacture and use of adsorbents in a wide variety of applications; this, the concluding paper, deals primarily with special uses.

Oils can be decolorized by distilling them in the presence of adsorbents which may contain acids. Contacting oils with adsorbents in the liquid phase may increase the gum content; this is avoided if the oils are distilled and the high boiling condensation products left in the distillation residue. The method has been recommended for refining cracked distillates; these distillates may be retreated until all the polymerizable materials are removed. The lubricating oil fractions may be distilled with the adsorbents eliminating the necessity of reheating the oil.

In refining vapor-phase thermally cracked distillates clay is injected continuously into the oil stream and the mixture heated to 600-650 F. at 200-500 psi in a tubular furnace. The unpolymerized fractions are vaporized by reducing pressure and the polymers are separated from the clay by passing the mixture through a Sweetland filter. As a modification the oil vapors may be passed at 1000 pounds pressure through the heater and through a stationary bed of fuller's earth before flashing and fractionating. Typical results obtained in refining the gasoline distillate from the Gyro vapor phase cracking process are shown in Table 10.

TABLE 10
Refining Vapor-Phase Cracked Gasoline With Clay at 600-625 F. and Under Pressure

Yield and Properties	Charge Stock	Product	Polymers
Volume, Percent	100.0	92.8	6.1
Gravity, °API	55.3	55.1	18.7
Astm Distillation, F.:			
Initial	90	100	392
10 Percent	148	158	508
50 Percent	284	288	632
90 Percent	400	386	760
End Point	424	410	
Color, Saybolt		30	
Gum content, mg/100 cc	High	0.2	

The Suspensoid process combines into one operation thermal cracking and polymerization of unsaturated compounds by injecting clay into the oil passing through the furnace.[160]

The Filtrol fractionation process was worked out for refining lubricating oil fractions.[3,143] Oil is mixed with the contact clay, heated to about 675 F. and pumped to the fractionating tower. Residuum containing the clay is passed to vacuum filters of the continuous rotating type. They are precoated with a three-inch layer of filter-aid on a monel screen. About 0.0004 inches of the filter aid is scraped off with the spent clay during each revolution. The quantity of clay employed regulates the color of the fractions affecting flexibility of the process. The residual fractions may be retreated with additional quantities of clay.

Vapor-Phase Refining With Adsorbents

Refining with adsorbents in the vapor phase is an old process,[106,107]

but for many years it was not used commercially because of the limited interest in the manufacture of gasoline before automobiles appeared on the market. The method is restricted to the refining of low boiling point fractions which can be vaporized without decomposition. Suggestions were made for refining lubricating oils with adsorbents at below atmospheric pressure but they were not applied commercially.

The vapor-phase treating process may be divided into two groups: polymerizing processes operating at temperatures slightly above the vaporization point of the distillate, and desulfurizing processes operating close to cracking temperatures of the hydrocarbons. The same substance may act as a polymerizing or a desulfurizing agent depending on temperatures employed.

Polymerizing Process

These processes are used for reducing the gum content and improving the color and oxidation stability of cracked distillates. The improvement is obtained by removing selectively the highly unstable hydrocarbons, the diolefins. In the absence of diolefins, the olefins present in substantial quantities in the thermally cracked products are stable. Sulfuric acid and other chemicals attack both diolefins and olefins and the refining losses are high. The losses in vapor phase refining with the adsorbents are one to two percent and even less.[75]

Fuller's earth is used widely for polymerizing olefins in the vapor phase, but bauxite, aluminum oxide, bentonite, activated clays, magnesite, iron oxide or Weldon mud, minette which is an ore containing iron and phosphorus,[161] charcoal or boneblack, activated carbon, and lithium chloride deposited on silicic acid might be useful. The relative efficiencies of fuller's earth and bauxite in vapor phase refining depend on the characteristics of the distillate treated.[5] Zinc chloride and some other chemicals have a similar polymerizing action.

In the Gray vapor-phase polymerization process[2,104,131,152,171] the hydrocarbon vapors are passed through the bed of fuller's earth at temperatures slightly above their condensation point. The high boiling polymers of the diolefins are formed and separated as a liquid at the bottom of the tower. The treated vapors are passed to the condensers. In order to save heat and to obviate the necessity of reevaporating the gasoline fractions, the hydrocarbon vapors are passed from the cracking units directly to the treating towers, preferably after the noncondensable gases are removed.

The treating towers are usually about ten feet in diameter and 30 feet high and contain 30 tons of fuller's earth, but the dimensions are not critical and vary within wide limits depending on the size of the unit and the operating methods. The exhausted fuller's earth is discarded or regenerated in outside kilns. For uninterrupted operations two towers are used in parallel.

The 30/60-mesh fuller's earth is commonly employed, but some refineries prefer the 60/90-mesh earth. The mesh of the clay determines the pressure drop across the tower. The temperature of the hydrocarbon vapors inside the tower is maintained as close as possible to the equilibrium vaporization temperature. The boiling point of the polymers is high and their separation as liquids from the gasoline vapors is not difficult. In treating gasoline the vapor temperature is usually maintained at 350-400 F., but varies with the pressure employed and the gasoline boiling range.

High treating temperatures favor cracking reactions instead of polymerization and the life of catalyst is shortened by deposition of carbonaceous materials. High pressures improve the catalyst life[71] and pressures of a few hundred to a thousand pounds per square inch are preferred. Periodic reductions in pressure assist in draining the polymers from the clay bed if the flow of vapor becomes restricted. When the process was first introduced the yields varied from 100 to 400 barrels of gasoline per ton of clay.[123] They were raised to 3000 to 30,000 barrels after the operating variables were investigated.

The flow of gasoline vapors is usually downward, but it might be in the reverse direction. The downward flow assists in draining the polymers and reduces the time the polymers are left in contact with the clay; this protects the polymers from decomposing and depositing the carbonaceous matter. The downward flow reduces the tendency of the vapors to channel and the catalyst carry-over at high vapor velocities. However, separation of polymers from the outgoing vapors is more difficult than in the upward flow. The towers should be insulated to reduce condensation of polymers on the catalyst adjacent to the tower walls.[178]

Success of the process depends on the complete separation of polymers from the treated product. The presence of traces of polymers has a detrimental effect on gasoline stability although the initial color may not be affected. Good fractionation can be accomplished within the clay bed but with the upward flow of vapors a small fractionator might be desirable.

Many recommendations were made for improving separation of polymers from the treated product such as the use of reflux within the treating tower, introduction of a hydrocarbon solvent into the tower, passing vapors through several layers of fuller's earth and separating the polymers after each passage, or passing vapors through a heavy hydrocarbon oil maintained at a suitable temperature. For increasing the life of fuller's earth by reducing the time of contact of polymers with the earth, velocity of the vapors through the tower may be raised and the polymers separated from the vapors by passing the mixture through a fractionating tower. For obtaining the maximum gasoline yield, the polymerized fractions may be mixed with a heavy oil and redistilled. Other suggestions include passing hydrocarbon vapors through the treating tower in admixture with steam or gaseous hydrocarbons, passing hydrocarbon vapors first through a partially spent and then through a fresh clay bed, treating vapors of the low and high boiling fractions with fresh and partially spent clays, respectively, introducing the clay into the distillation still with the reflux oil. Heat from the oil vapors might be recovered.

Duplication of plant results in the laboratory is comparatively difficult. Pressure, temperature, time of contact and vapor velocity must be reproduced accurately,[41] and the operation must not be interrupted.

Gasoline refined with clay in the vapor phase has a good color and oxidation stability,[12] but its anti-knock rating and unsaturation, measured by iodine number and other chemical tests, are not changed. Sulfuric acid refining produces more stable products,[24] but this additional stability is seldom needed. If necessary, it may be obtained by treating the vapor-phase refined product with small quantities of acid. Washing of the vapor-phase treated gasoline with a sodium hydroxide solution or water is often necessary for removing the traces of hydrogen sulfide that might be present. Addition of small quantities of hydrogen chloride or ozone to the gasoline vapors before passing them through clay is said to improve stability of the product. The vapor-phase treated gasolines are further stabilized with inhibitors like para-aminophenol, alpha-naphthol or amino-benzenes.

Polymers of the diolefins obtained in vapor-phase refining have some drying properties and might be used

as cheap varnish substitutes. They may be stabilized by refining with sulfuric acid. They are often cracked or blended with fuel oils.

Vapor-phase refining stabilizes distillate fuel oils obtained from the cracking processes. The treating loss is very small and the product is stable without addition of inhibitors.

Gasoline may be first stabilized at low vapor temperatures and then desulfurized over the same kind of fuller's earth or catalyst at high temperatures. The two operations may be reversed but the catalyst life is shortened.

Desulfurizing Process—

Vapor-phase desulfurizing processes employing fuller's earth, bauxite and other adsorbents employ temperatures which are sufficiently high for cracking most of the sulfur compounds, but below the cracking range of the hydrocarbons. Hydrogen sulfide is liberated and removed from the oil by fractionation or by washing with alkaline solutions. Splitting of hydrogen sulfide does not result in the complete destruction of hydrocarbon molecules; the hydrocarbon radicals form new compounds, many of them boiling within the boiling range of the product. The yield of the desulfurized distillates is high as compared with the yields obtained from the processes involving complete removal of the sulfur containing molecules.

Catalysts suggested for catalytic desulfurization include fuller's earth which might be improved in activity by kneading and shearing under pressure, bauxite, clays, acid treated clays, silica gel, synthetic silica-alumina catalysts, charcoal, activated carbon, green-sand, kaolin, granite, gravel, cellulose materials, and many chemicals, such as zinc chloride and others. Many of these substances are also cracking and polymerization catalysts. The catalysts differ in their desulfurizing efficiency and their choice depends on the nature of the refinery stocks.[5]

Fuller's earth, bauxite and the synthetic silica-alumina catalysts are among the common desulfurizing agents of the adsorbent type used in vapor phase refining. The selection is made on the basis of the local problems the refinery has to meet. These catalysts are not uniform and their source or method of preparation are important. Bauxite is a satisfactory desulfurizing catalyst[83] and commercial methods were developed for preparing it to meet the diversified refinery needs.[29] Not all the bauxites have the same desulfurizing properties and some of the deposits are relatively inactive.[16, 110] Attempts were made to correlate the chemical composition of bauxites and clays with their desulfurizing efficiencies but the results are inconclusive. High lime content might insure the long catalyst life; high iron content might favor desulfurization[157] although the presence of iron sulfide is said to have little effect on its catalytic properties. A high iron content may be conducive to coke formation[83] and the stability of the treated product might be low. The desulfurizing and regenerative properties of alumina gels might be improved by the presence of copper oxide or chromium oxide.

DESULFURIZATION may improve the octane number and, particularly, the lead susceptibility from 1 to 13 points and more depending on the type of sulfur compounds removed. This improvement may be ascribed not only to sulfur removal, but also to isomerization of olefins.

The desulfurizing action of catalysts is claimed to proceed in two directions: decomposition of sulfur compounds with the resulting formation of hydrogen sulfide and breaking up of hydrogen sulfide into sulfur which is absorbed by the clay and hydrogen.[23, 111] Pure calcite, quartz, lime and kaolin are not effective in promoting the first reaction; the brown iron ore seems to promote this reaction. Dolomite was suggested for removing hydrogen sulfide from gasoline vapors before it is oxidized to elemental sulfur.[174]

Charcoal may have a considerable desulfurizing effect; a straight-run gasoline containing 0.140 percent sulfur including 0.067 percent of mercaptan sulfur was freed of mercaptans by treating its vapor with charcoal and its sulfur content was reduced to 0.04 percent at 750 F. and to 0.006 percent at 850 F. These results are comparable with those obtained with bauxite and clays.

The individual sulfur compounds vary widely in refractivity. Mercaptans and organic sulfides are relatively unstable and split off hydrogen sulfide at comparatively low temperatures.[26] Thiophene is more stable but may be forced to release sulfur.[17] Some of the reactions are reversible; olefins and hydrogen sulfide react under proper conditions to form mercaptans. Many catalysts, including silica gel[11] are effective in removing sulfur from the sulfides.

Stocks, such as natural gasolines, containing only the aliphatic sulfur compounds can be almost completely desulfurized,[164] but the removal of aromatic sulfur compounds is difficult; some of them are more stable thermally than the bulk of the hydrocarbons in the charge stock. Natural gasolines containing 0.25-0.30 percent sulfur can be desulfurized over bauxite to a 0.004-0.005 percent sulfur content. Catalytic desulfurization is well-adapted to the straight-run distillates which contain large quantities of aliphatic sulfur compounds.[26]

The catalytic vapor phase desulfurization processes are operated at temperatures of about 750 F.,[42] below the hydrocarbon cracking ranges, but temperatures as high as 880-1100 F. were suggested. High temperatures are often desirable for reducing the sulfur content of the product,[25] but this tendency may be reversed if excessive temperatures are used.[172] This is caused by the inter-reaction of hydrogen sulfide liberated at low temperatures with the hydrocarbons at high temperatures showing the importance of removing hydrogen sulfide as soon as it is produced. In catalytic cracking the sulfur content of the gasoline is usually low. At high conversions the sulfur content of catalytic gasoline is low and that of cycle stock is high; at low conversions the sulfur content of both products is reduced, but the reduction is less for gasoline.[87] For equal conversions, the sulfur content of gasoline is less at low cracking temperatures.[172] Variations in the nature of charge stock may alter these relationships. For instance, the sulfur content of cracked gasoline might show first an increase and then a decrease as the temperature is raised. Lowering of the sulfur content of gasoline with the increase in cracking severity is observed also in the thermal cracking processes. The degree of desulfurization depends in either case on the type of crude processed.[13, 32] In catalytic desulfurization high flow rates of oil vapors through the catalyst may be desirable for reducing cracking hydrocarbons.

Catalytic desulfurization may be combined with cracking reforming or alkylation processes. Although the sulfur content of catalytic gasolines is low, desulfurization of charge stocks to the catalytic and reforming units[89] reduces corrosion of equipment. Corrosion is less in the desulfurizing than in the cracking units because of the lower temperatures involved.

Desulfurization may improve the octane number and, particularly, the

lead susceptibility from 1 to 13 points and more depending on the type of sulfur compounds removed.[81] This improvement may be ascribed not only to sulfur removal, but also to isomerization of olefins.[89]

Many variations in the vapor-phase desulfurization technique were suggested. The desulfurizing activity of clay might be enhanced by mixing the gasoline vapors with those of gas oil, heavy distillates and other hydrocarbon materials. A broad petroleum fraction may be vaporized, the vapors passed through the clay bed, the gasoline fraction condensed, washed with sodium hydroxide solution and recontacted with clay in the vapor phase. The temperature of oil vapors may be controlled by introducing an inert gas or water into the reaction zone and the desulfurized product fractionated. Cracked gasoline vapors may be treated first at low temperatures, to polymerize the gum forming constituents, and then at high temperatures to remove sulfur, or the low boiling fractions may be treated at a different temperature than the high boiling or sulfur bearing fractions. Before passing through the clay bed, the oil vapors may be mixed with chemicals, such as hydrochloric acid, sodium hydroxide, carbon monoxide, alcohol, sulfur, mercaptans or disulfides, sulfur dioxide, oxygen and steam, and others. The treated oil vapors may be freed from hydrogen sulfide and a portion of them recirculated through the catalyst. Instead of passing through a clay bed, the vapors may be contacted with a clay slurry. Inert gas may be employed to prevent infiltration of vapors into the unused portion of the catalyst bed. Countercurrent contact of catalyst and oil vapors is recommended. Retreating gasoline vapors with silica-alumina catalyst after refining with bauxite was suggested.

Vapor phase desulfurizing processes employing catalysts of the adsorbent type are the Gray desulfurization process using fuller's earth, Perco desulfurization process using bauxite, and Houdry desulfurization process using an activated clay or a synthetic silica-alumina catalyst. In these processes the oil vapors are passed through a stationary catalyst bed and the catalyst is regenerated in situ. Application of the fluid technique and the use of colloidal dispersions of fuller's earth or bog iron ore has been suggested.

Gray Desulfurization Process

In the Gray desulfurization process the oil vapors are passed through a bed of fuller's earth at 700-750 F. The process is similar to the Gray polymerization process with the exception that high temperatures are employed and no polymers are formed. The rate of flow of vapors through the catalyst bed is adjusted to the nature of the stock and the degree of desulfurization desired. Yields of the finished products vary from 800 to 1200 barrels per ton of clay and are sometimes as high as 5000 barrels. Laboratory data obtained on treating a sample of gasoline with various types of fuller's earth and bauxite are shown in Table 11.[134]

The relative efficiencies of the catalysts may not be the same at other treating temperatures. The nature of the charge stock may affect the comparisons.

Perco Desulfurization Process

In the Perco desulfurization process the oil vapors are passed over bauxite at 700-750 F. and at pressures up to 50 psi.[29, 150, 163] Treating conditions are adjusted depending on the nature of charge stock and degree of improvement desired. One ton of bauxite may treat from one hundred to three hundred barrels of gasoline between regeneration. The catalyst is regenerated with air and steam at several week intervals. More frequent regenerations are required in treating cracked than straight-run distillates. Products, like natural gasoline, are desulfurized completely or almost completely; reduction in the sulfur content of straight-run naphthas is from 60 to 100 percent, that of cracked gasolines is from 40 to 60 percent depending on the type of sulfur compounds present.

TABLE 11

Vapor - Phase Desulfurization of Straight-Run Gasoline With Fuller's Earth and Bauxite at 700 F.

Gasoline Properties	Charge Stock	CATALYST			
		Fuller's Earth		Bauxite	
		Type A	Type B	Type A	Type B
Gravity, API	59.1	59.2	58.9	58.9	58.8
Color, Saybolt	30	21	26	20	21
Sulfur, Percent by Weight	0.076	0.0022	0.0003	0.000	0.001
Gum Content, mgs./100 cc.					
Copper Dish	5	4	6	6	4
ASTM	1	4	1	1	1
Octane No.:					
Clear	58.4	60.4	60.8	60.4	59.0
3 cc. TEL	72.6	80.6	80.9	81.0	79.9

NOTE: Boiling range of charge stock and products about 110-390 F.

TABLE 12

Catalytic Refining of Cracked Naphtha by Houdry Treating Process at 800 F. and 50 Lbs. Per Square Inch Pressure

Properties	Charge Stock	Treated Gasoline	
		Motor	Aviation
Gravity, API	39.2	48.0	59.4
ASTM Distillation, F.:			
Initial	164	95	108
End Point	410	396	301
Sulfur, Weight Percent	0.07	0.04	0.03
Aniline Number, F.	66	68	100
Acid Heat, F.	81		19
Induction Period, Hrs.	0.75	18	11
Gum, mg./100 cc.:			
Copper Dish	997	3	1
Glass Dish	3	1	0
Doctor Test	Positive	Negative	Negative

Houdry Catalytic Treating Process

The process is used primarily for refining cracked gasolines.[99, 146, 181] Temperatures may vary from 600 to 800 F. and pressures up to 50 psi are employed. Low temperatures are used for eliminating diolefins and other unstable hydrocarbons and high temperatures for desulfurization. Two reactors are used for securing a continuous flow of oil vapors through the unit; one of the reactors is on stream while the other is on the regeneration cycle. Catalyst is regenerated with air. The temperature is regulated by pumping a molten mixture of sodium nitrite and potassium nitrate through tubes equipped with fins and located inside the reactor. Typical results are shown in Table 12.

Ion Exchange Agents—

Substances like bentonites, some of the synthetic gels and organic resins, possess the property of exchanging ions with solutions with which they are brought in contact. The reaction is reversible depending on the type of solution employed and treating conditions.[34] The crystalline silicates entering such reactions are known as zeolites.[91] The ion exchange compounds may be divided into anion and cation exchangers and are of inorganic or organic origin, some of them prepared synthetically.

The main application of the ion exchangers is in the field of water softening, but attempts were made to extend their usefulness to petroleum refining. Ion exchangers were suggested for removing sodium soaps from the acid treated and neutralized oils, for eliminating acidic sulfur compounds, like mercaptans, from the petroleum distillates and for extraction of phenolic substances and nitrogen compounds. Light distillates containing mercaptans may be treated with mercuric or cadmium oxide before contacting with the zeolites. Bakelites treated with strong sulfuric acid and other cation or anion exchangers are claimed to be efficient in removing the last traces of acid and prevent discoloration and gum formation in the distillates.

End of Part V and series.

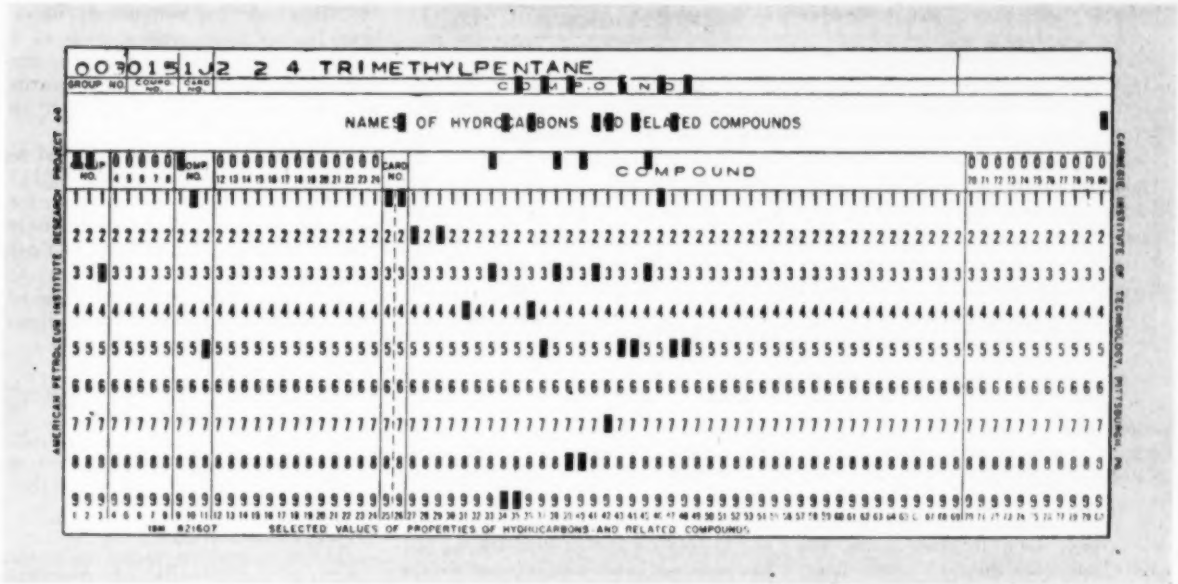


Figure 1. Name card for 2,2,4-Trimethylpentane looks like this . . .

Now available on punch cards . . .

Physical Data on Hydrocarbons

• Punch cards enhance use of data from API Project 44 on hydrocarbons and related compounds.

• These data include selected values of physical and thermodynamic properties for more than 935 compounds.

Jack Sherman, The Texas Company, Beacon, N. Y.

DURING THE past ten years the American Petroleum Institute Research Project 44 has been concerned with collecting, analyzing, calculating, and compiling selected values of physical and thermodynamic properties, and critically collecting and compiling infrared, ultraviolet, Raman, and mass spectral data, all on hydrocarbons and related compounds. The indexing of spectral data has received considerable attention by means of punch cards. However, the large number of individual numerical values available on the physical and thermodynamic properties have heretofore received scant attention from the standpoint of utilizing these cards. As of June 30, 1952, the tables of the API Research Project 44 cover 935 different compounds and include more than 110,000 individual numerical entries. This body of data, now available on approximately 1000 loose-leaf sheets, constitute the most reliable and comprehensive information existing for hydrocarbons and related compounds.

The utility of the data can be enhanced by increasing the ease of finding particular values of properties and of finding groups of compounds having selected ranges of values. After thorough consideration, it was decided that the best means of making the data more conveniently available was to punch them into standard cards. Most large organizations have punch card machines in their accounting departments and many now have these machines in their laboratories for scientific computing.

The large variety of physical and thermodynamic data available in the tables of the API Research Project 44, and the different precisions with which they are known, present difficult problems of designing cards which can be conveniently used. It was decided to prepare the punched cards containing the data in as nearly the same arrangement as on the printed sheets as possible, with the restriction that one card never contain data for more than one compound. At a later time it may be desirable to give consideration to changing this arrangement by condensing or otherwise modifying it, as experience dictates.

Since the sets of cards will be made available only through the API Research Laboratory at the Carnegie Institute of Technology, it was considered essential for the convenience of the machine operator that specially printed cards be made to accommodate the various data. Consequently, following the arrangement of the printed tables, it was decided to prepare specially designed cards for each of the properties or set of properties corresponding to a particular letter desig-

This report was prepared for the API Research Project 44 at the Carnegie Institute of Technology and presented before the Division of Petroleum Chemistry of the ACS at Los Angeles, March, 1953.

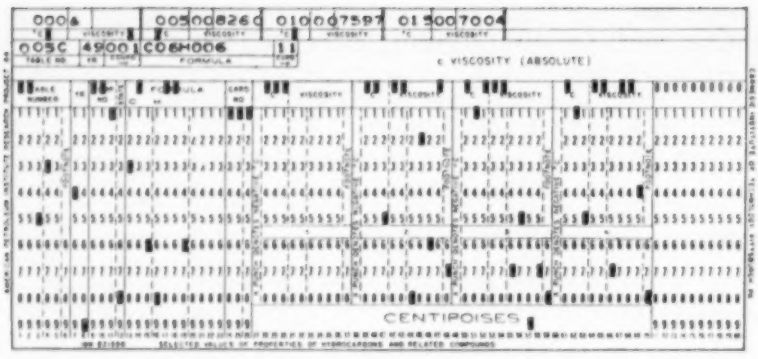


Figure 2. Data card for the viscosity of benzene.

nation. Furthermore, it is clear that, because of the lengths of the names of some of the hydrocarbons, it would be impractical to punch the names in full in the same cards which contain the various data. In some cases, the names are more than 43 letters long, so that there would be very few card columns left for data. For this reason each compound within a given group was assigned a "compound number." A set of "name cards" was prepared giving this compound number and the name of the compound in full.* When listing is desired, the name cards can be collated in front of data cards so that the name and corresponding data will be printed side by side or one below the other.

In preparing the cards, the aim was to devise a system which would be as widely used as possible. Consequently, no particular scheme of coding or arrangement was utilized which would necessitate the operation of punch card machines not generally in use. If a customer has machines not widely distributed, he may wish to prepare from the standard set of cards a special deck which would take advantage of the capabilities of these machines.

For easy identification it was decided to obtain cards with different colored stripes to denote different tables or groups of tables. For this purpose, the scheme listed in Table 1 was adopted.

Name Cards—A typical name card is shown in Figure 1 for 2,2,4-trimethylpentane. It is seen that the first 3 columns of the card show the group number to which the compound belongs. Thus, 2,2,4-trimethylpentane belongs to the third group, namely paraffins, C_n. The various classes of the compounds and their numerical designations are shown in Table 2.

In order to be consistent with the arrangement of the data cards, columns 4 to 8 are left blank on the name cards. Columns 9, 10, 11 contain the compound number, which is 15 for 2,2,4-trimethylpentane. This number does not appear on the printed sheets, but has been assigned consecutively within each group. Inasmuch as the compounds are listed in the same order in each of the tables of properties, a given compound is uniquely specified by giving its group number and compound number, except in a few cases where the same compound is listed in two groups, for example, methane in Groups 1 and 20.

Columns 12 through 24 are left blank on the name cards. As explained in a later section, columns 13 through 23 on the data cards contain the stoichiometric formula of the compound. It could also be inserted in the name cards. However, it was decided not to do so because the name cards might then contain more than 43 alphabetical characters, and consequently the formula could not be listed along with the name with one pass of the cards unless a 407 or a 403 tabulator were used. However, if a particular customer wishes to have the stoichiometric formula in the name cards, he can easily do so by reproducing it from the corresponding cards of the "a" tables.

Column 25 contains the card number, which is 1 for 2,2,4-trimethylpentane. In most cases, only one name is given, and the card number is thus "1". However, for compounds which have two or more names, such as 2 methylpropane and isobutane, the names are punched on separate cards and the cards numbered 1,2, etc., in column 25.

In column 26 a "1" is punched to indicate the first card and a "11" punch to indicate the last card. For the majority of compounds having only one name, both "1" and "11" (X) are punched in column 26.

Starting in column 27, the name of the compound is punched. The following points should be noted:

(1) Commas and hyphens, as in 2,2,4-trimethylpentane are indicated by spaces (blank columns).
(2) Where the structure is uncertain and is indicated by a question mark on the printed sheet, e.g. cis(?)-3-methyl-2-pentane, the question mark is punched as the letter "Q" thus: cis Q 3 methyl 2 pentane.
(3) For compounds having alpha and beta in the formula, e.g. α-methylstyrene, the alpha is punched as letter "A" and beta as "B."
(4) For compounds of groups 28 and 29, some of the names such as 1,cis-2-Dimethyl-[1,2,3,4-Tetrahydronaphthalene] would require more than 43 card columns if punched out in full according to the above mentioned rules. However, 43 type bars are the maximum number from which alphabetical characters may be listed on the IBM type 402 and 405 tabulators. Consequently, these unusually long compound names have been condensed by using the letter C for cis, T for trans, and by omitting the spacing between some of the numbers. Thus, 1, cis-2-Dimethyl-[1,2,3,4,-Tetrahydronaphthalene] is punched as 1 C 2 Dimethyl 1234 Tetrahydronaphthalene.

TABLE 1
Significance of Colored Stripes on Cards

Color	Significance
Brown	Molecular Weights of Hydrocarbons.
Red	Names of Compounds.
Green	Tables r, s, t, u, v, w, x, and y containing thermodynamic properties as a function of temperature.
Salmon[1]	Tables designated by an E suffix to denote Engineering Units.
Gray	Tables having a K or G suffix to denote units other than Engineering or basic.
Yellow[1]	All tables not included in one of the above categories.

[1]The stripe is between numbers 1 and 2 on the second cards rather than along the top edge.

TABLE 2
Compounds and Their Number Designations

Group	Compounds
00	O, H, N, C
0	O_2,H_2OH,H_2O,N_2,NO,C,CO,CO_2
1	Paraffins, C_1 to C_5
2	Paraffins, C_6 to C_7
3	Paraffins, C_8
4	Paraffins, C_9
5	Alkyl Benzenes, C_6 to C_9
6	Alkyl Cyclopentanes, C_5 to C_7
7	Alkyl Cyclohexanes, C_6 to C_8
8	Monoolefins, C_2 to C_6
9	Monoolefins, C_7
10	Monoolefins, C_8
11	Diolefins, C_3 to C_6
12	Acetylenes, C_2 to C_5
13	Styrenes, C_8 to C_9
14	Alkyl Benzenes, C_{10}
15	Alkyl Cyclopentenes, C_8
16	Alkyl Cyclohexenes, C_9
17	Paraffins, C_{10}
18	Alkyl Cyclopentanes, C_8 to C_7
19	Alkyl Cyclohexanes, C_8 to C_9
20	Normal Paraffins, C_1 to C_{40}
21	Normal Alkyl Benzenes, C_6 to C_{42}
22	Normal Alkyl Cyclopentanes, C_5 to C_{41}
23	Normal Alkyl Cyclohexanes, C_6 to C_{42}
24	Normal Monoolefins (1-Alkenes), C_2 to C_{40}
25	Normal Acetylenes (1-Alkynes), C_2 to C_{40}
26	Alkyl Benzenes, C_{11}
27	Naphthalenes, C_{10} to C_{12}
28	Terehydronaphthalenes, C_{10} to C_{12}
29	Decahydronaphthalenes, C_{10} to C_{12}
101	Normal 1-Alkanethiols, C_2 to C_{20}
102	Normal 2-Alkanethiols, C_3 to C_{20}
103	Alkanethiols, C_4 to C_5
105	2-Thiaalkanes, C_2 to C_{20}
107	Thiaalkanes, C_2 to C_5
108	Thiaalkanes, C_6
114	Alkyl Thiophenes, C_4 to C_6
115	Alkyl Thiophenes, C_7

* In a few cases where more than 43 columns would be required to punch the name in full, some abbreviations were introduced, such as C for cis and T for trans.

(5) For compounds of groups 28 and 29 which have brackets within the name, the right or lefthand bracket is punched as a 12 (or Y) punch. This will list as a "&" or "—" or whatever special symbols are in the type bars of the particular machine being used.

The name cards contain an X punch in column 80 for control purposes.

Data Cards—Each card which contains one or more values of properties for a particular compound must also have sufficient identifying information to specify the compound. Great care was given to the problem of how much identifying information should be punched into each card. The scheme shown in Table A was finally adopted: The scheme below is illustrated by the data card for the viscosity of benzene shown in Figure 2.

The 5 columns for the table number are subdivided into 3 columns for the numerical part of the table number and 2 columns for the letter component. The numerical part of the table number signifies the particular group of hydrocarbons to which the given one belongs. The letter designation signifies the particular group of properties concerned.

Column 6, labeled "footnote" is used in two ways:

(1) A "9" punch in column 6 signifies that there is a footnote to the entire table on the printed sheets.
(2) An "8" punch in column 6 signifies that for the k-tables and k-F tables, the card contains the constants of the Antoine equation from which boiling points and vapor pressures may be computed, rather than the values themselves. A k-table or k-F table card without an "8" punch in column 6 contains actual values of vapor pressures and boiling points.

Columns 9, 10, 11, contain the compound number within a given group. Column 12 indicates the physical state of the compound in cases where it is desirable to designate it. The code for the state is quite simple, as shown by Table B.

TABLE A

Colums on the Card	Significance
1 to 5	Table number.
6	Footnote.
7, 8	Year of latest revision of data, as shown on printed sheets.
9, 10, 11	Compound Number.
12	State (gas, liquid, solid).
13 to 23	Stoichiometric formula.

TABLE B

Punch	Significance
9	Gas
8	Liquid
7	Solid, crystalline form I
6	Solid, crystalline form II
5	Solid, crystalline form III
4	Solid, crystalline form IV

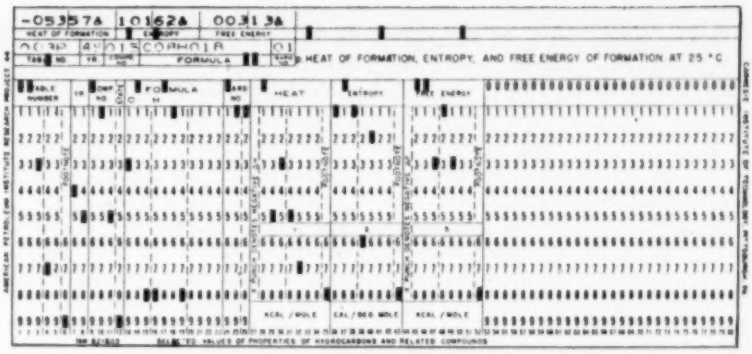


Figure 3. Data card giving the heat of formation, entropy, and free energy of formation at 25 C. for 2,2,4-trimethylpentane.

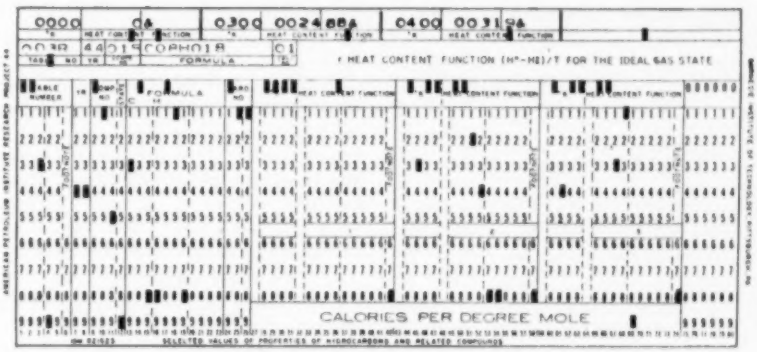


Figure 4. Data card giving the heat content function for 2,2,4-trimethylpentane.

It is seen that the card for the viscosity of benzene shown in Figure 2 gives values for benzene in the liquid state.

The field of 11 columns for the formula is divided into 3 subfields. The first one is a field of 3 columns, 13, 14, and 15, in which in column 13 the letter C is punched to denote carbon, and columns 14 and 15 are used for punching the number of carbon atoms in the compound. Similarly, columns 16 to 19 are provided for punching the letter H and the number of hydrogen atoms. Columns 20 to 23 provide four additional columns to take care of oxygen, sulfur, the halogens, etc.

For ease of sorting, a consistent number of digits is punched for each compound, namely two for the number of carbon atoms and three for the number of hydrogen atoms. The viscosity card therefore, shows that benzene, C_6H_6, is punched as C06 H006.

The arrangement of the first 23 columns as described in the previous paragraph has been followed for all the compounds and properties. Moreover, the information contained in these columns is interpreted (printed) on the second line of interpretation on each card, except for columns 6 and 12 (footnote and state). The formula obviously does not distinguish between isomers. However, the compound number and the group number (numerical part of the table number) determines the identity of the compound except for a few cases where a compound is given in 2 or more groups. For example, benzene is listed as the first compound in group 5, the alkyl benzenes C_6 to C_{36}, and also the first compound in group 21, the normal alkyl benzenes C_6 to C_{42}.

Table 3 gives a list of the letter designations identifying the various properties tabulated.

General Considerations

(1) *Varied Precisions of Property Values.*

The actual property values for each compound are punched in card columns starting with 27. The number of columns allotted to each property value includes just a sufficient number to accommodate the values containing the greatest number of digits. Since the precision of a given property value is not the same for all compounds, the number of digits varies. In order to give positive indication of the number of digits in a particular value, a "Y" is punched in the first column of the field beyond the last significant digit, providing that the number of digits is less than the maximum. For example,

it is seen on the card shown in Figure 3 that in columns 28 to 34 the values of the heat of formation in the "p" table have been allotted 7 digits of which three precede the decimal point. If a value of the heat of formation is given to only two decimal places a "Y" punch is inserted in the third decimal position to signify that the third and fourth decimal places are not available. In the interpretation, the "Y" punch is shown as an asterisk. It is seen on the card in Figure 3 for 2,2,4-trimethylpentane that the heat of formation is —53.57 kcal/mole. If the value may be negative, the first column of the field is reserved for an "X" punch to signify this negative value. If a value is omitted entirely from the printed sheets a "Y" is punched in the first column of the field.

TABLE 3

Properties and Their Letter Designations

Letter	Properties	Units
a	Boiling Point at 1 atm dt/dp at 1 atm	°C
	Refractive Index, n_D at 20 C. and 25 C.	°C/mm Hg
	Density at 20 and 25 C.	g/ml
	Freezing Point in air at 1 atm.	C
a-E	Boiling Point at 1 atm dt/dp at 1 atm	F
	Refractive Index, n_D at 68 and 77 F.	F./in. Hg
	Density at 60, 68, and 77 F.	lb/ft³; lb/gal
	Specific Gravity, 60 F./60 F.	°F
b	Freezing Point in air at 1 atm.	ml/mole
	Molecular volume at 20 and 25 C.	ml/mole
	Molecular Refraction at 20 and 25 C.	ml/g
	Specific Refraction at 20 and 25 C.	ml/g
	Refractivity Intercept at 20 and 25 C.	ml/g
	Specific Dispersion at 20 and 25 C.	Centipoises
c	Viscosity (Absolute) at given temperatures in C.	Centistokes
c-E	Kinematic Viscosity at given temperatures in F.	Centistokes
c-K	Kinematic Viscosity at given temperatures in C.	g/ml
d	Density at given temperatures in C.	lb/ft³
d-E	Density at given temperatures in F.	K, C, R, F, atm; lb/in.², g/ml; lb/ft³, liter/mole; ft³/lb mole
e	Surface Tension	
f	Critical Temperature	
	Critical Pressure	
	Critical Density	
	Critical Volume	
	Critical Compressibility Factor	
k	Vapor Pressures at 10 to 1500 mm Hg	mm Hg
	Boiling points at 10 to 1500 mm Hg	C.
k-E	Vapor Pressures at given temperatures F.	lb/in.²
	Boiling Points at given temperatures F.	°F
m	Heat of Vaporization at 25 C. and normal boiling point	kcal/mole; cal/g
	Entropy of Vaporization at normal boiling point	cal/deg mole
n	Heat of Combustion at 25 C., for liquid and gas	kcal/mole; cal/g; Btu/lb
p	Heat of Formation at 25 C.	kcal/mole
	Free Energy of Formation at 25 C.	kcal/mole
	$Log_{10}K_f$ at 25 C.	
	Entropy at 25 C.	cal/deg mole
	Heat Capacity at 25 C.	cal/deg mole
q	Std. Heat of Vaporization at 25 C.	kcal/mole
	Free Energy of Vaporization at 25 C.	kcal/mole
	Std. Entropy of Vaporization at 25 C.	cal/deg mole
r	Heat Content Function, 0 to 1500 K.	cal/deg mole
s	Free Energy Function, 0 to 1500 K.	cal/deg mole
t	Entropy, 0 to 1500 K.	cal/deg mole
u	Heat Content, 0 to 1500 K.	cal/mole
u-E	Heat Content, —459.69 to 2200 F.	Btu/lb
u-G	Heat Content, —273.16 to 1200 C.	cal/g
v	Heat Capacity, 0 to 1500 K.	cal/deg mole
v-E	Heat Capacity, —459.69 to 2200 F.	Btu/lb deg F.
v-G	Heat Capacity, —273.16 to 1200 C.	cal/g deg C.
w	Heat of Formation, 0 to 1500 K.	kcal/mole
x	Free Energy of Formation, 0 to 1500 K.	kcal/mole
y	Logarithm of Equilibrium Constant of Formation, 0 to 1500 K.	
z	Heat of Fusion	kcal/mole
	Entropy of Fusion	cal/deg mole
	Cryoscopic Constants	mole fraction/deg
	Freezing Points at saturation pressure and in air at 1 atm	°C; °F

The first column of the field is reserved for an "X" punch to signify this negative value. If a value is omitted entirely from the printed sheets a "Y" is punched in the first column of the field.

Exceptions to the above rules are made for the 12 thermodynamic tables, r,s,t,u,u-E,u-G,v,v-E,v-G,w,x, and y. The number of columns assigned to each of the three fields is made uniform. This results in some blank columns on some of the cards. For example, for the "r" tables, it is seen from the card shown in Figure 4 for 2,2,4-trimethylpentane, that columns 27, 43, and 59, are blank for the reason the temperatures in °K are necessarily positive, and therefore, no sign is needed. However, in the "u-E" tables, the temperature is expressed in °F and the foregoing columns contain X punches to indicate negative values. Similarly, columns 32, 48, and 64, are blank on the "r" table cards because the heat content function is always positive.

(2) *Properties Which Are Given for Different Temperatures.*

The 29 classes of tables as indicated by the letter designations fall into two groups. Tables a, a-E, b, i, m, n, p, q, and z, give various properties of compounds at one or two temperatures, such as 25 C. For these tables, at most 2 cards are sufficient to contain all the data for one compound. However, for the remaining tables the values such as viscosity, heat capacity, etc., are given for many different temperatures for each compound. The thermodynamic tables are quite regular in their range of values of the independent variable, namely, temperature. However, for the tables of viscosity and density, the range of temperatures varies considerably among the various compounds. One method of handling this problem would be to punch only one property value and its corresponding temperature on one card. However, this would result in a complete deck of cards of the order of 100,000 and would be unwieldy in its use. It was, therefore, decided to punch as many property values in a given card as could conveniently be inserted. For specific applications, the user might wish to reproduce the data into separate cards.

In order to achieve a consistent system of punching which would be convenient in actual machine operations, it was considered essential to have a fixed arrangement of temperatures in the cards. For example, for all the compounds listed in the "c" tables, the extreme temperature range is from —200 to +200 C. Viscosities are given at 5 C. intervals and 4 viscosity values can be accommodated on each card. It would, therefore, require 21 cards to show the 81 viscosities for compounds which cover the full temperature range. However, this is not the case for any one compound. Each compound covers a portion of the range between —200 and +200 C. The system adopted for handling the various ranges of temperatures for which the viscosity values are available was to number the cards from 1 to 81, in which card number 1 always contains the temperatures —200, —195, —190 and —185 C., card number 2 contains the next 4 temperatures, etc. The first card for which viscosities are available for a given compound is indicated by a one punch in column 26. Thus for benzene, table 5c shows the first viscosity value for 5 C. This is punched in the second field of card number 11, since this card gives the temperatures 0, 5, 10, 15 C. Since there are no viscosity data for benzene to be inserted in the first 10 cards, that is, for temperatures less than 0 C., the 11th card contains the one punch in column 26. In this manner, cards for which no data are available need not be included for a given compound.

The highest temperature for which viscosity data are shown for benzene in Table 5c is 85 C. This value will occur in the second field of card number 15. Since there are no data to be inserted into cards 16, 17 · · · an X is punched into column 26 of card number 15 to show that it is the last card in the series.

In those cases where no data at all exist for a particular compound within a given group, but the compound is shown on the printed sheets, the identifying information through column 23 is punched. The card number in columns 24 and 25 then shown are 00. No data being available, the remaining columns of the card are therefore blank.

In some tables, such as u-E giving the heat content for various temperatures

TABLE 4

Arrangement of card numbers and card columns for the data on heat content for the ideal gas state in the u-E tables.

CARD COLUMNS				
24, 25	26	27 to 31	43 to 47	59 to 63
Card Numbers		Temperatures in °F.		
1		—460	0	32
1	2	—300	—250	—200
1	3	—150	—100	— 50
1	4	50		
2		60	68	77
3		100	200	300
3	2	150	250	350
4		400	500	600
5		700	800	900
6		1000	1100	1200
7		1300	1400	1500
8		1600	1700	1800
9		1900	2000	2100
10		2200		

in F., for example, the Table 1 u-E which gives heat contents for the paraffins C_1 to C_5, values are given for temperatures such as —300 F. which do not occur for any other of the u-E tables. In order to conserve cards, these "special" temperatures are shown on cards designated as card 01, etc., in columns 24 and 25 containing 1, 2, 3, etc., and a supplementary punch in column 26. This signifies that these cards are additional cards for a few compounds.

For the u-E tables the card numbers and temperatures on each card are shown in Table 4.

(3) *Footnotes*

On the printed sheets, footnotes are frequently given along with the data to indicate various points such as the fact that the substance is a supercooled liquid. These footnotes obviously cannot be punched into the cards. However, in most cases it is quite important for the user to know their contents. It was, therefore, decided to insert a simple code into the cards to indicate the presence of a footnote on the printed sheets. Accordingly, the last column of the field for a property value is labeled "footnote" and is used in conjunction with the code shown in Table C.

The number six code in the footnote column is used, for example, in order to designate an absolute temperature of 298.16 K. In the thermodynamic tables, this temperature is frequently used. Wherever it occurs, it is punched as 298 rather than 298.16. This device is desirable in order to achieve consistency in the number of card columns assigned to the temperature field, and to eliminate the necessity of assigning two columns for decimal places because of this one occurrence.

Wherever possible, the footnote as given on the printed sheets is incorporated into the punching. For example, in Table 27A, the refractive index for naphthalene (compound No. 1) is given in parentheses in the 25 C. column as 1.5898, with a footnote which states that the temperature is 85 C. On the card, the value of 1.5898 is punched for the refractive index in columns 53 to 58. The temperature in columns 51 and 52 is punched as 85 rather than 25.

(4) *Discussion of Specific Tables*

TABLE C

Punch	Significance
9	Footnote in printed sheets to tabulated value only.
5	Footnote in printed sheets to entire column.
7	Footnote in printed sheets to both individual value and entire column.
6	The value punched is different from that given in the printed sheets, in cases where it is convenient to do so.

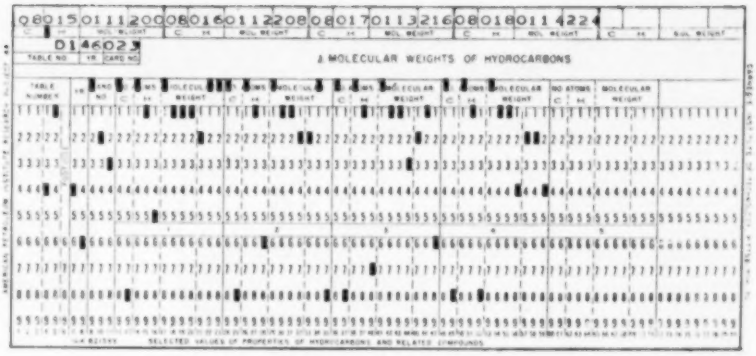


Figure 5. Data card giving molecular weights.

(a) "y" Tables—In the "y" tables, the logarithm of the equilibrium constant of formation at 0 K. is infinite for compounds. This is punched into the card as 999.99999 together with a 6 in the footnote column 42 to signify that the value punched is not identical with that given on the printed sheets.

(b) Molecular Weights—The molecular weight cards have a slightly different arrangement than the other data cards. This table is designated as on the printed sheets and is punched as D-1 (to denote δ) column 4 and 5 of the card. Five molecular weight values are given on each card, as is seen by the card shown in Figure 5.

(c) Thermodynamic Tables, r, s, ··· y—For the thermodynamic properties, values of increment per CH_2 group are shown on the printed sheets. These incremental values are punched into separate cards. The formula is shown as CH_2 and the compound number is shown as 0.

For the heat capacity of the branched-chain heptanes and octanes, the printed sheets contain a footnote to the effect that until more data become available, the heat capacity of any branched-chain heptane or octane may be taken to be equal to that of the normal hydrocarbon. Consequently, for each of the compounds shown on the printed sheets, the heat capacities given for the normal hydrocarbons are punched into separate cards with an appropriate punch for the footnote.

(5) *Interpretation of Data*

In all cases, provision is made along the top of the card for interpretation (printing) of the property values. X punches in the card are interpreted as minus signs and Y punches are interpreted as asterisks. The footnote columns are not interpreted.

Uses of the Cards

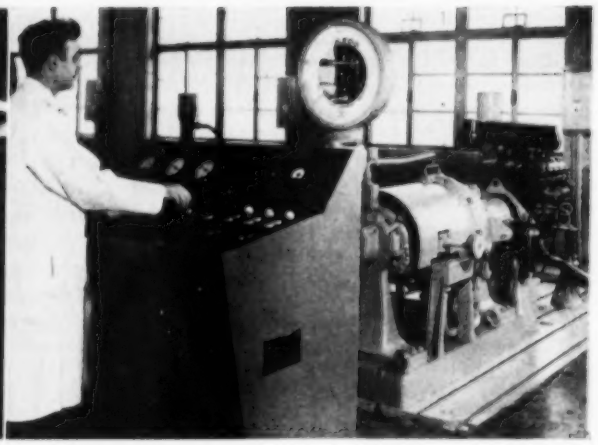
On the foregoing pages, detailed descriptions have been given of the development of the arrangements and codes that have been used in transferring the data from printed sheets to punched cards. The uses to which these cards may be put are so varied that it would be impractical to evaluate them in any complete sense. However, it may be mentioned that one of the important uses anticipated for the cards is that of searching for specific compounds having specified ranges of properties. No attempt will be made to describe the operations of the various punched-card machines. Nevertheless, it may be stated that cards corresponding to specific ranges of properties may be obtained by use of the collator or sorter. If the properties of interest are on different sets of cards, the two sets, after selection, must be matched by means of the collator. In order to list out these properties together with the names of the hydrocarbons the matched decks of cards must then be sorted on compound number and class number in order to bring together values of the two properties for each compound. These cards must then be collated (merged) with the name cards for final listing. For compounds having more than one name, all the name cards will precede the corresponding data card.

For computing applications it would be desirable in most cases to reproduce from the original set of cards into a new set containing only one property value per compound per card. Specific computational procedures would depend upon the particular equipment available at each installation.

Availability of the Cards

Information regarding the availability of the punch cards containing the data on physical and thermodynamic properties of hydrocarbons and related compounds of the API Research Project 44 may be obtained by writing the American Petroleum Institute Research Project 44, Attention of Frederick D. Rossini, Carnegie Institute of Technology, Pittsburgh 13.

Dynamometer laboratory includes 16 engine test stands.



Isolated engine and dynamometer bed plate mounting prevents cross vibration.

New Automotive Laboratory Opened

STANDARD OIL COMPANY (Indiana) has added a new building—with complete facilities for full-scale engine testing of automotive fuels and lubricants—to its extensive automotive laboratory at Whiting, Ind.

The new building and dynamometer laboratory are adjacent to other buildings in Standard's research center at Whiting, where the company's program for developing new and improved automotive fuels and lubricants is conducted.

Every needed facility is at hand for the measurement and control of operating conditions for every make, size, or type of automotive engine that exists or can now be anticipated, officials declared.

In the new laboratory are 16 engine test stands, each with dynamometer and other modern control and measuring instruments.

Engine and dynamometer bed plates are mounted on separate three-ton concrete foundations which foot directly on sand under the building. Isolated from each other and from other parts of the building, these separate foundations eliminate cross vibration.

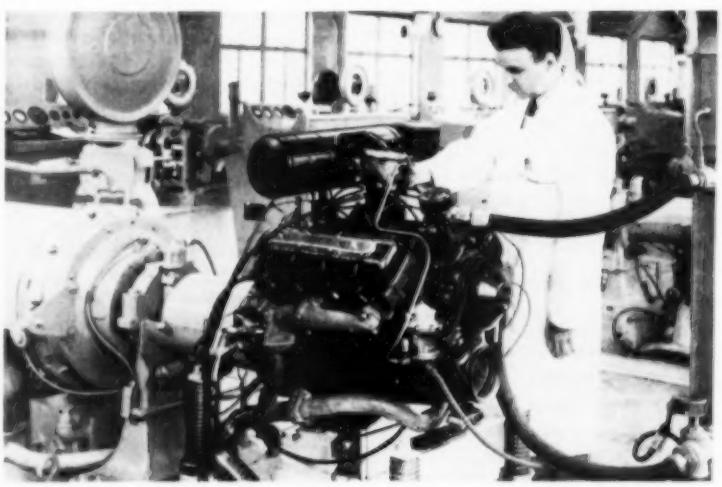
The new building adds 15,000 square feet to Standard's automotive laboratory, which was first established as a separate research unit in 1925.

In the typical test engine and dynamometer set-up, the design and arrangement of equipment permit precise control of engine speed and operating conditions over a wide range of situations.

Since the separately footed test stand foundations do not permit basement-type construction, exhaust gas outlets as well as electrical, fuel, water, and other service lines are channeled through tunnels cast in a concrete subfloor. To minimize the clutter and hazards of exposed connections, all pressure and vacuum lines, as well as thermocouple wire and control leads, are carried between engine control panels, engine, and dynamometer in trenches below floor level.

Fuel supply lines are mounted on the building wall adjacent to each test stand. Regular and special fuels may be supplied to each engine from tanks outside the building.

The new automotive laboratory has its special tank farm. There are adequate facilities for making up and storing commercial, special purpose, and experimental fuel blends for spark ignition, diesel, and jet engines. Ethyl fluid blending facilities are included.



Typical arrangement of fuel, water, exhaust and electrical connections of a test engine set-up.

Correlating . . .

Equilibrium Flash Vaporization Data

Petroleum Crudes and Fractions. Part II

From the correlations discussed in Part I this simple nomographic chart is made. Try this time saver.

Edward H. Ten Eyck and Donald F. Othmer,
Polytechnic Institute, Brooklyn

EXAMINATION of experimentally determined[2, 4, 16, 17]* or calculated[8] EFV curves of petroleum fractions or crudes at two different subatmospheric pressures shows they are almost equidistant from each other throughout their length; i.e., differences of temperature for the same pressure difference are about the same throughout the entire range of percent vaporized. The next step is to correlate the vertical or temperature displacement of the curves with changes in pressure.

The straight lines of Figures 3 to 6 indicate that, as always for this type of vapor pressure plot, a nomograph may be readily constructed using a vertical logarithmic pressure scale on the left and another vertical scale of temperatures on the right, calibrated from values corresponding to those on a logarithmic scale for the vapor pressure of water. Intermediate between these two general scales, good for all vapor pressures of all types of all materials, there will be a locus of the points representing the relation for an individual material; in this case for a fixed percentage vaporization line of a plot such as Figures 3 to 6. These focal points, a separate one for each percentage vaporized, will fall on a third scale between the first two. These focal points are empirically located and form a straight line for materials of a similar nature, as for a homologous series of pure hydrocarbons.

The nomograph of Figure 8 (reproduced on the following page) was so constructed. A dotted line for the focal points of normal paraffins was added, simply to demonstrate application of this plot to homologous series. The use of the solid scale allows ready determination of an EFV temperature of any crude or fraction for a desired pressure, or vice versa from another EFV temperature at the corresponding pressure. In use, the temperature at the known 50 percent vaporized point and the total pressure are connected by a straight line. The focal point for the mixture is at the intersection of this line with the diagonal solid focal point line. By swinging a straight edge to values of pressure on the left axis, the corresponding temperatures on the right axis are easily read for the 50 percent vaporization point, or vice versa. Care should be used not to approach the critical temperature of the mixture. While the 50 percent vaporized point is the one most frequently concerned because it is in the center of the data and therefore known with better precision, the temperatures or pressures for other percentage vaporized points can be found in this manner. Thus it is possible to develop the entire EFV curve at any desired pressure, if it is known at one pressure.

The use of this chart may be exemplified with the experimental data of Othmer, Ten Eyck and Tolin[16] at 49 mm of mercury pressure for the Mid-Continent heavy naphtha. The 50 percent vaporized temperature is 172° F; and it is desired to find the corresponding temperatures for constructing a flash curve at atmospheric pressure. A straight edge is placed between the 49 mm point on the left-hand pressure scale and the corresponding 172° point on the right-hand temperature scale. The point is noted where the straight edge crosses the diagonal focal point line. Relaying the straight edge on this point, and extending through 760 mm, a boiling temperature of 318 F is obtained. (This was also the experimental value.) Similarly, there may be obtained values for other temperatures corresponding to other percentages vaporized, and the whole EFV curve may be constructed. An alternate method would be to draw the EFV curve through the new 50 percent point and equidistant from the original curve.

A quantitative measure of the accuracy of this method is presented in the accompanying table. Errors obtained in extrapolating the temperature at the lowest experimental pressure to that of the highest experimental pressure, as illustrated in the previous example, are shown for six of the systems studied.[16]

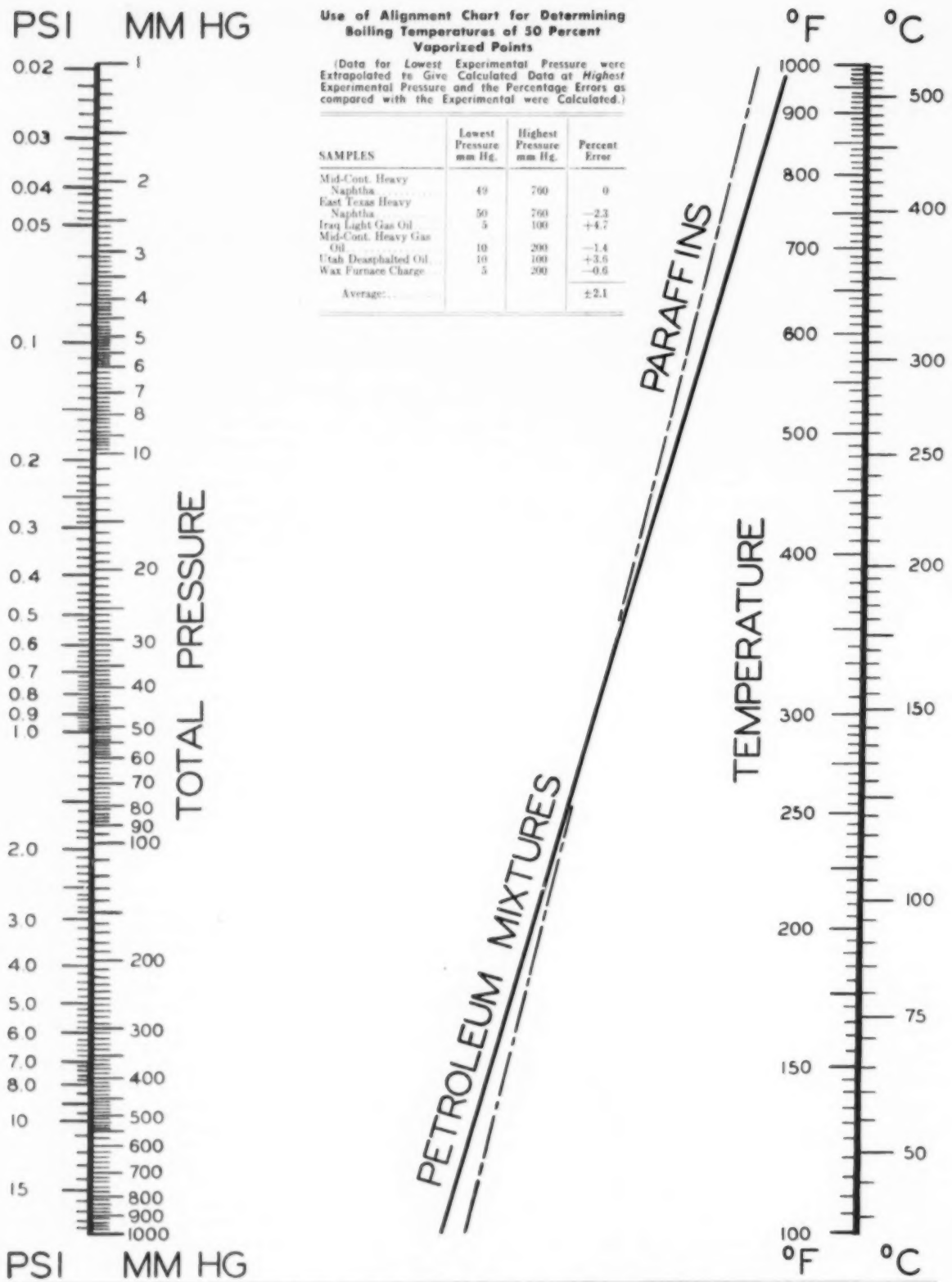
If data have been taken at two or more pressures, the error obtained by this method is greatly reduced since the focal points can be established with much greater accuracy. In this case the intersection of the two (or more) lines drawn between their respective temperatures and pressures is used for the focal point. This point may be slightly displaced from the diagonal line drawn to represent the locus of focal points, which is only a general line for all petroleum materials and not as good an indication as a determination from values taken at two or more pressures of the specific crude or fraction. Temperature readings at other pressures are obtained simply by moving the straight edge to the pressure desired, aligning with the focal point and reading the temperature on the right-hand scale. The accuracy of the data obtained by the use of two points is shown by the logarithm of total vapor pressure versus the logarithm of the vapor pressure of water plots shown herein. In all cases studied, the lines are practically straight over the entire pressure range.

The general applicability of this type of alignment chart is illustrated by using the focal line for normal paraffins. Figure 8 was constructed for and can be used directly to determine vapor pressures at various temperatures for pure compounds, as well as any mixtures if the vapor pressure at two temperatures are known so that two lines to give an intersection can be drawn.

(See nomograph, Figure 8, on next page.)

End of Part II and series.

* References are listed at end of Part I of this 2-part paper, September, 1953, page 229.



Use of Alignment Chart for Determining Boiling Temperatures of 50 Percent Vaporized Points

(Data for *Lowest* Experimental Pressure were Extrapolated to Give Calculated Data at *Highest* Experimental Pressure and the Percentage Errors as compared with the Experimental were Calculated.)

SAMPLES	Lowest Pressure mm Hg.	Highest Pressure mm Hg.	Percent Error
Mid-Cont. Heavy Naphtha	49	760	0
East Texas Heavy Naphtha	50	760	−2.3
Iraq Light Gas Oil	5	100	+4.7
Mid-Cont. Heavy Gas Oil	10	200	−1.4
Utah Deasphalted Oil	10	100	+3.6
Wax Furnace Charge	5	200	−0.6
Average:			±2.1

Figure 8. Pressure-Temperature Nomograph for Petroleum Fractions or Crudes: To use, locate known equilibrium pressure and temperature for a given percent vaporized on left and right scale, respectively. Intersection with solid line in center gives the focal point. A line drawn through this point to any other pressure gives the corresponding temperature, or vice versa, for this particular percentage vaporized. This same chart may be used to indicate temperatures-pressure relation for any other material or mixture. The corresponding temperatures at two pressures are connected. The intersections of these lines are focal points determining all other temperature and pressure relations. Two such focal points for two members of a homologus series may be connected to give a focal line good for all members of the series—or any mixture of members.

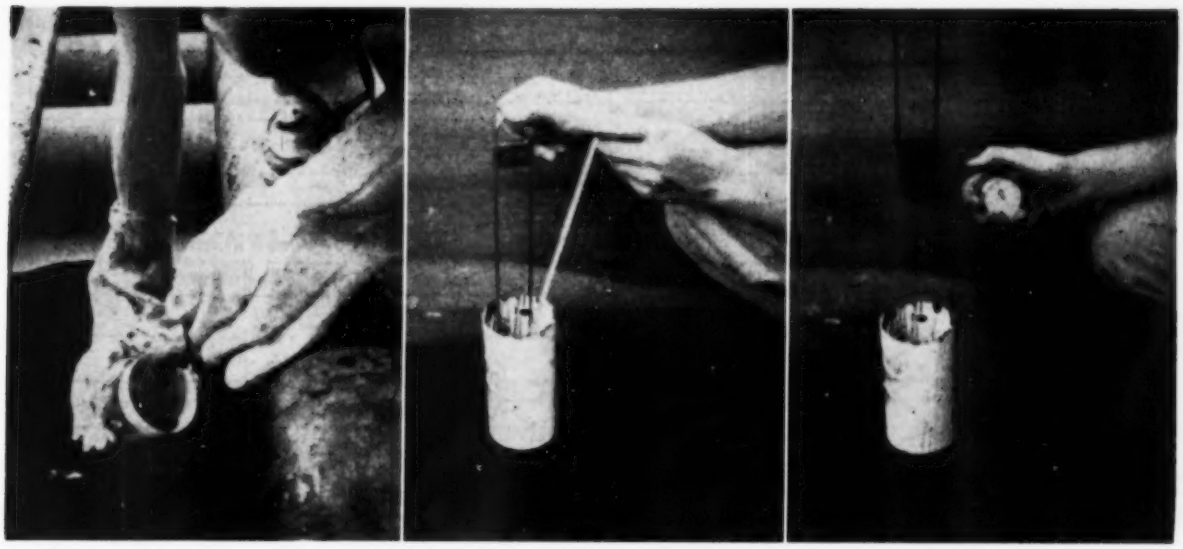


FIGURE 1. THE EXPERIMENTAL PROCEDURE

1. Tapping the sample **2.** Stirring the sample **3.** The actual test

On the spot . . .

Asphalt Quality Test

This novel method for checking the quality of asphalt from topping units is rapid, inexpensive, and accurate.

Robert E. Weaver and M. M. Gilkeson,
The Tulane University of Louisiana,
New Orleans

RECENTLY A novel on-the-spot test for asphalt quality has been developed at the Tulane University Practice School. This method, which is based on an empirical correlation between the standard penetration specification and the kinematic viscosity (as measured with a "cup" viscosimeter), presents an inexpensive, rapid, yet highly adequate control indication for asphalt topping units.

The standard ASTM penetration test[1] requires nearly an hour from the time of sampling to the time penetration test values can be reported back to the topping unit. Cooling the sample tapped at 500 F. down to the necessary thermal equilibrium at the standard test temperature of 75 F., for instance, requires considerable time. In addition, the penetration value is critically dependent on the other test conditions, in particular, on the accurate timing of the five-second free fall of the penetrometer needle. These factors significantly limit both the speed and accuracy of the penetration test.

Advantages of Cup Viscosimeter—The cup viscosimeter, on the other hand, provides the means for a high-temperature test which can be run at the unit site. And the simple experimental procedure involved demonstrates its advantages over the penetrometer test, as well as over the Saybolt and similar tests now in use in refinery laboratories. The cup viscosimeter consists of a metal cup of approximately 40 cubic centimeters capacity whose dished bottom is pierced by a machined, 0.106-inch orifice. The actual test procedure involves no more than inserting the cup into the asphalt, stirring until a uniform temperature has been obtained, and then lifting the cup quickly from the sample (see Figure 1). The time interval between the initiation and break of the resultant flow through the orifice is measured. The entire test actually requires less than five minutes. In addition, the troublesome temperature equilibrium problems is minimized since the cup data can be based on any convenient initial temperature—if the cooling occurs at a uniform and reproducible rate. For a given initial temperature and relatively uniform climatic conditions,

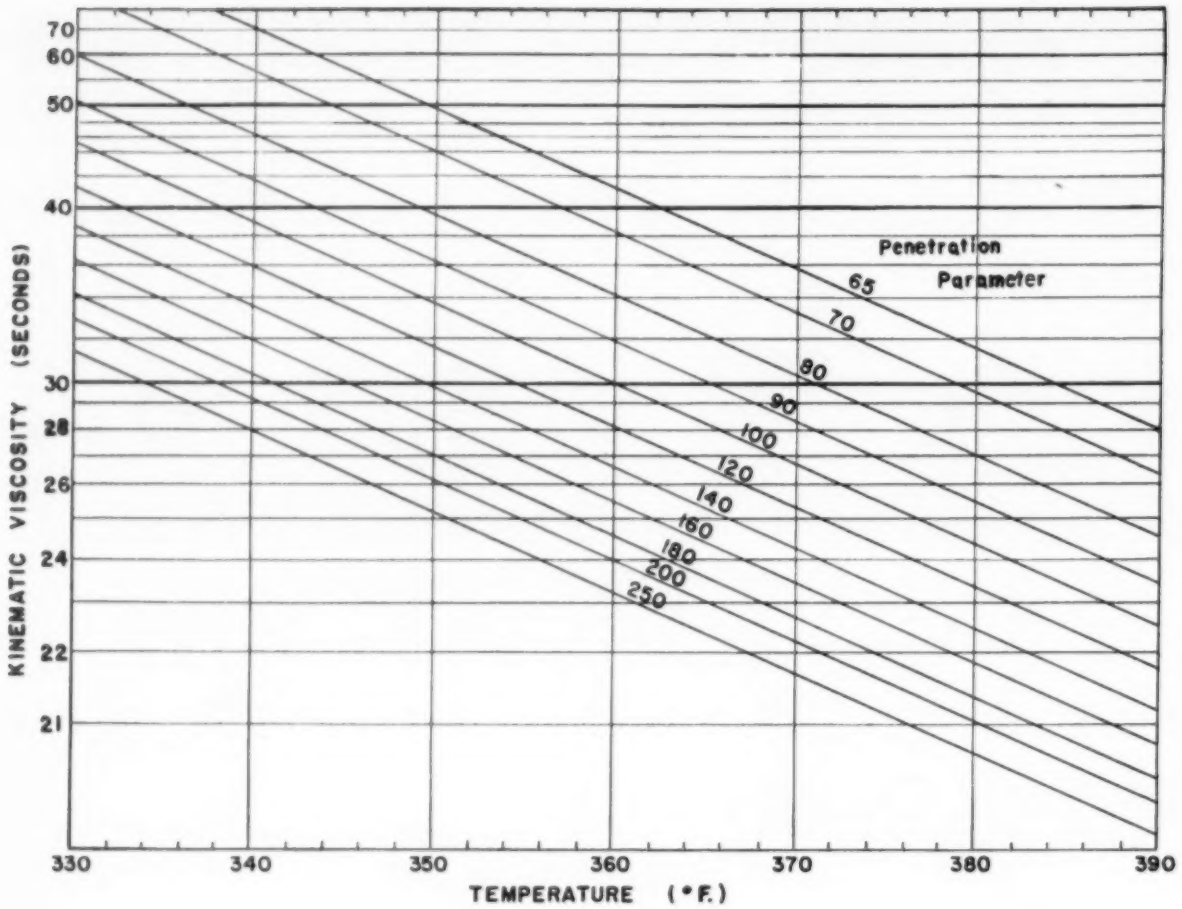


Figure 2. The test correlation (Baxterville base)

this assumption is well founded. A further advantage lies in the fact that the cup viscosimeter is small and of simple shape. The apparatus is easily handled, and the orifice is readily accessible for cleaning purposes.

The theoretical basis for correlation of the penetration with viscosity is seen in the fact that both tests actually measure the fluid's resistance to internal shear. In fact, the penetration test was designed originally to give a relative measure of viscosity, and Saal[2], Koens[3], and others[4,5,6] have shown that the two properties are intimately related.

Convenient Plot—The pertinent variables of the test can be most conveniently represented by a plot of the time-of-flow versus the temperature of the asphalt (at initiation of flow), with the standard penetration test values as the parameter. Figure 2 presents such a correlation based on the authors' work with asphalts of 65 to 250 penetration. The data have been plotted on a synthetic non-linear coordinate system which produced parallel straight lines for the penetration parameter. (The coordinate system was suggested by the nature of the data when plotted on linear coordinates and was developed simply by fitting the ordinates so as to describe the data by a straight line.) While the system describes an exponential function of some sort, it was not found to approach any of the more conventional systems.

This correlation was checked with confirmatory runs made at an asphalt topping unit, which indicated a reproducibility within plus or minus five percent. As the asphalt is still identified within the commercial penetration "grade" specification, it does not appear that this is a serious limitation on the use of the method as an on-the-spot test.

The data presented in Figure 2 are applicable only to asphalt derived from Baxterville crude and are based upon a cooling rate corresponding to a surroundings temperature of about 80 F. However, the extension of this relationship to other materials or conditions can be made with little difficulty.

The type of test presented here has already found considerable use in the paint, varnish, and lacquer industry[7] and it should find a useful place in the petroleum refinery where the expense of continuous indicating or controlling instruments is not jusified.

ACKNOWLEDGMENT

The authors wish to acknowledge the contributions and cooperation of Cary Brackin, Francis White and other Pan-Am Southern personnel, and R. G. Wooten and F. J. Touro of the Tulane University Practice School.

BIBLIOGRAPHY

[1] "Penetration of Bituminous Materials," ASTM Standards, Part III, (D5-25), 194, (1944).

[2] Saal, R. N., Proc. World Petroleum Congr., London, **2**, 515, (1935).

[3] Saal, R. N., and Koens, G., J. Inst. Petroleum Technol., **19-I**, 176, (1933).

[4] Traxler, R. N., Pittman, C. U., and Burns, F. B., J. Appl. Phys., **6**, 58, (1935).

[5] Pfeiffer, I. J., and Van Doormal Ir. P., J. Inst. Petroleum Technol., **22-I**, 414, (1936).

[6] Rencowitz and Boe, Ind. Eng. Chem., Anal. Ed., **8**, 157, (1936).

[7] Zahn, E. A., Gen. Elec. Review, **40**, 285, (1937).

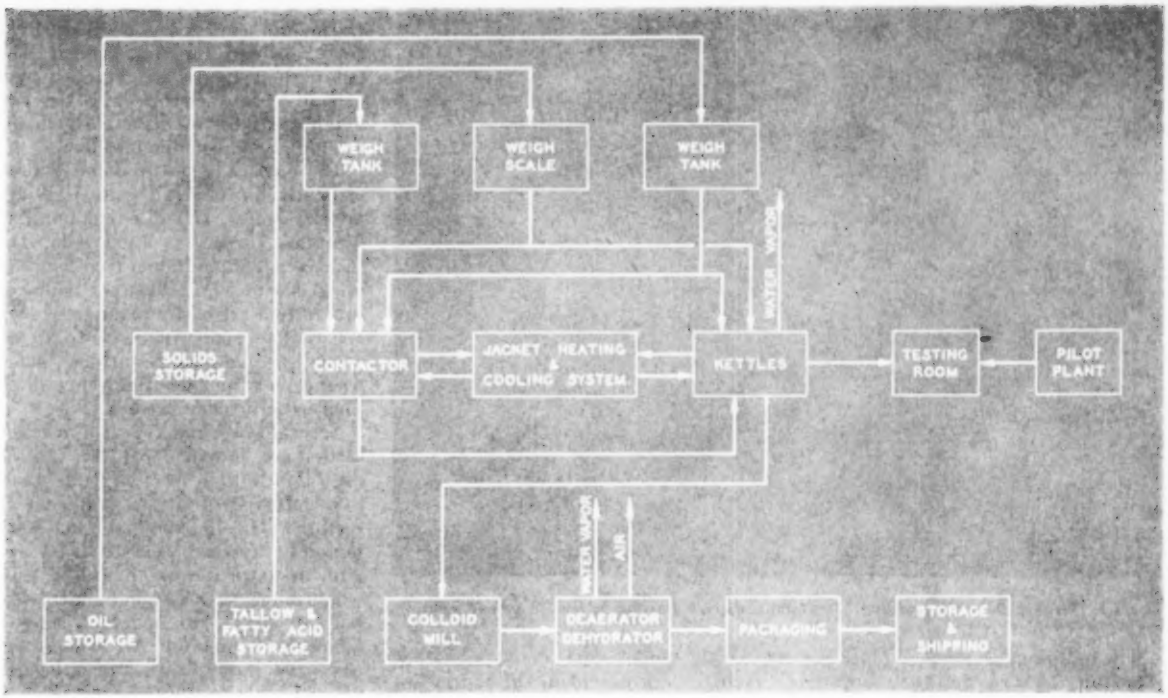


Figure 1

Modern Grease Plant Goes on Stream

Novel design features of this huge new Canadian plant include:

- Centralized control of operations
- Unusual weighing techniques for ingredients
- Hot and cold oil kettle cooling
- High capacity deaerator-dehydrator

C. O. Rinearson[1] and C. W. Nofsinger[2]

"MOST MODERN grease plant on the American continent."

This comment was made by an old-timer well known in the grease business after looking over British American Oil Company's new grease plant at their Clarkson Refinery near Toronto, Canada. This modern 15 million pound per year plant started in April and produced several hundred thousand pounds of grease in its first two weeks' operation. The indications are that the plant will easily attain its rated capacity when operating eight hours per day, five days per week. The cost of the plant was approximately $1,500,000.

The C. W. Nofsinger Company of Kansas City, Mo. was in charge of the engineering design. N. A. Armstrong of Toronto designed the building. British American carried out purchasing and expediting as well as the off-site work, while Pigott Construction Company of Toronto was the general contractor. These forces have combined to provide the company with a plant which represents the last word in complete grease manufacturing and handling facilities and is capable of producing a full range of greases of consistently high quality and uniformity. Production from the plant will supplant the products formerly purchased by the company to supply its market for solid lubricants. Raw materials to be processed in the new plant will be almost entirely of Canadian origin. The petroleum oils being used are naphthenic lube oils from the company's Montreal East refinery and paraffinic lube oils from the Clarkson refinery. The finished grease will be distributed thruout Canada.

The principal types of greases for which the facilities were designed to manufacture include calcium greases, sodium greases, lithium greases, barium greases, mixed-base greases and non-soap greases. Raw materials required for the operation of the plant include a full range of fats and fatty acids, both saturated and unsaturated. The different basic ingredients involved in the saponification processes are purchased to rigid specifications to ensure the highest quality of soap. The mineral oils include a wide range of viscosities and types.

Unique features of this plant are:

- Centralized control of operations
- Weighing of all ingredients used in grease making
- Hot oil heating and cold oil cooling of kettle equipment
- Pressure-vacuum contactors and kettles
- High capacity mill and dehydrator-deaerator

[1] The British American Oil Company, Ltd., Clarkson, Ontario, Canada.
[2] The C. W. Nofsinger Company, Kansas City, Mo.

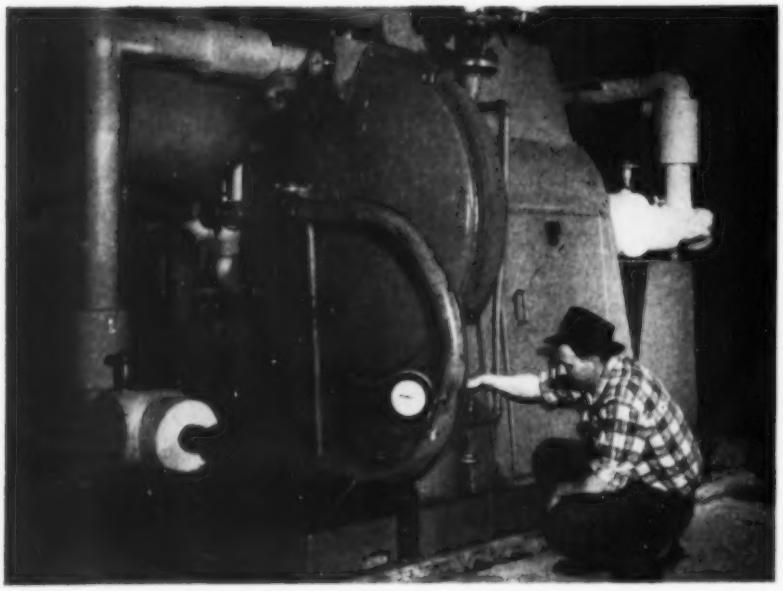


Figure 2. This special design deaerator-dehydrator is vacuum operated to remove air and moisture.

The building, of concrete block construction, covers an area approximately 100 x 240 feet. That part of the building which houses the storage tanks, contactors, kettles, pilot plant, laboratory and other process and utilities equipment, is three stories high, while the section occupied by the filling lines, warehouse and shipping departments is of single story construction. The plant is located alongside a railway spur line and a covered loading platform extends the entire length of the building to facilitate the handling of incoming and outgoing materials. Provision is also made for shipping by truck transport.

The grease manufacturing equipment is distributed over three floors. The third floor houses principally the weigh tanks from which charge stocks flow by gravity to the floor below. The second floor is the site of several important operations. The furnace and the oil circulation pumps are located here. The centralized control board on this floor makes for convenient operation of the entire grease-making process. In order to facilitate the checking of ingredients and formulations, the grease testing and pilot plant rooms are located here in close proximity to the manufacturing area. The second floor also has storage space for a current supply of dry chemicals. On the first floor are located storage and other tanks, charge stock pumps, and grease finishing and packaging equipment. Here also are the offices and a pressurized electrical control room. Empty and filled container storage space is located in an adjoining single story section of the building.

Both indoor and outdoor storage facilities are provided. Oil and tallow may be unloaded from tank cars by a pump provided for this purpose at the unloading rack. The oils may also be brought from the refinery lube oil storage tanks. Five outside storage tanks are provided for miscellaneous lube oil stocks. Each of these has a built-in suction steam heater and is serviced by its individual reversible pump. It is possible, by means of flexible hose and couplings, to pump from any tank, either indoors or out, into any other tank.

Indoors, oils are stored in six tanks and are maintained at above room temperature by means of individual suction-type steam heaters built into the tanks. The fatty acid and tallow storage tanks are insulated and have side entering mixers. These materials are maintained at 120 to 150 F. by means of steam heating coils on the outside of the conical bottoms of the tanks. Adequate temperature controls and indicators are provided for each inside tank and heater. Each tank is serviced by an individual pump for pumping out and for recirculation through the heaters.

The flow of process materials from storage to weigh tanks is controlled from the instrument board by means of hand control valves. In addition to the scale dials at the equipment, remote dials are provided within viewing distance of the control panel so that weighing can be done by the operator at the panel. The piping at the weigh tanks is arranged so that the process materials can be returned to storage if necessary. Each tank is provided with a high level signal and alarm and emergency overflow to a tank provided for this service. The tallow weigh tanks are wrapped with outside steam coils while the two weigh tanks for oil have coils on the outside of the cone bottom only.

The furnace is gas fired and is automatically controlled with necessary safety features. The oil circulation rate thru this furnace is 1500 gpm. The furnace is unique in that transfer rates of 40,000 to 50,000 Btu per hour per square foot are easily maintained over a period of many years. Since no deposits form on heating surfaces, maintenance is at an exceedingly low level. Thermal efficiency exceeds 80%.

Several sizes and types of reaction kettles are provided for the sake of flexibility with respect to both quantity and type of grease to be manufactured. The 15,000-pound and 8000-pound kettles may operate under vacuum or at pressures up to 150 psig, whereas the 12,000-pound kettle has a flat top and is for operation only at atmospheric pressure. All of these kettles have jackets thru which heating oil and, on occasion, cooling oil may be pumped. Two smaller kettles, one of which is jacketed, are for the manufacture of cold sett greases. Still another small kettle is used for melting tallow and other compounds and can also serve as a rundown tank. The 6000-pound contactor is common to all these kettles. It is used primarily for carrying out the saponification reaction, but it may also be used for the dispersion of soap into the oil when required. All kettles are equipped with mixers, whereas mixing in the contactor is by means of a high circulation impeller in the center of a circulating tube located at the bottom of the vessel.

When a batch of grease is finished, it is pumped from kettle thru a colloid mill. The pump is specially designed to maintain the pressures required in the handling of the different grades of grease. The purpose of the mill is to bring about homogeneity of product and to improve the mechanical and storage characteristics of the lubricant. From the mill, the grease passes to the dehydrator-deaerator. This equipment, again of special design for this plant, operates under vacuum to remove entrained air and any undesired moisture. Removal of the air increases the oxidation resistance of the grease and allows the product to assume the normal color of the oils used. When the grease leaves the deaerator it is pumped to one of the three conveyor line filling stations.

The grease, in all cases, is drawn from the kettles at the first floor level and may be passed thru grease mill

and dehydration equipment or directly to packaging as desired. This finishing equipment is of high capacity, i.e., 300 to 1000 pounds per minute.

Packaging of 100-pound kegs, 25-pound pails, 10-pound and 5-pound cans is done automatically. Drums of 400-pound capacity and the kegs are filled at the maximum rate which can be handled by the finishing equipment. Containers such as the 25 to 35-pound are filled at the rate of 15 per minute and 10 and 5-pound cans at a rate of 30 to 60 per minute.

Full use is made of conveyor systems. Conveyors have been arranged for unloading the empty containers from freight cars to the empty container storage area, located adjacent to the packaging area. Another conveyor brings the empty containers to the packaging area where they are filled, weighed and stenciled. The filled containers are loaded onto pallets which are taken by a gasoline driven fork truck to the storage area. Space is provided to store 500,000 pounds of grease in containers which hold 5, 10, 25, 100 and 400 pounds, respectively.

The actual grease making operation may be described briefly as follows (See Figure 1):

The contactor is charged with the required amount of fat or fatty acid and heated to 200 F. in less than ten minutes. When this temperature is reached, the alkaline dry solids which have been weighed during the heating process are also charged to the contactor and the vapor outlet valve closed. The temperature is then raised rapidly to 350-400 F. The pressure is then about 70 psig. When this temperature is reached, the soap is flushed into the finishing kettle, which has already been partially filled with oil and heated to about 200 F; the quantity of this oil is generally sufficient to bring the kettle contents to 40 percent of the final volume. The batch is in some cases then heated again to 350-400 F. During this operation a large part of the water will be vented off. When closed kettles are used, the pressure is reduced gradually and eventually a vacuum may be applied by means of a steam jet ejector in order to reduce the water content to the required amount.

At the end of this operation, the remaining oil is charged to the kettle at a temperature sufficient to reduce the overall batch temperature to the proper packaging or milling temperature which ranges from 150 to 250 F. In some cases, it is necessary to circulate cooling oil through the kettle jacket. Facilities are provided for this purpose. The grease is circulated for 10 minutes longer to produce a uniform

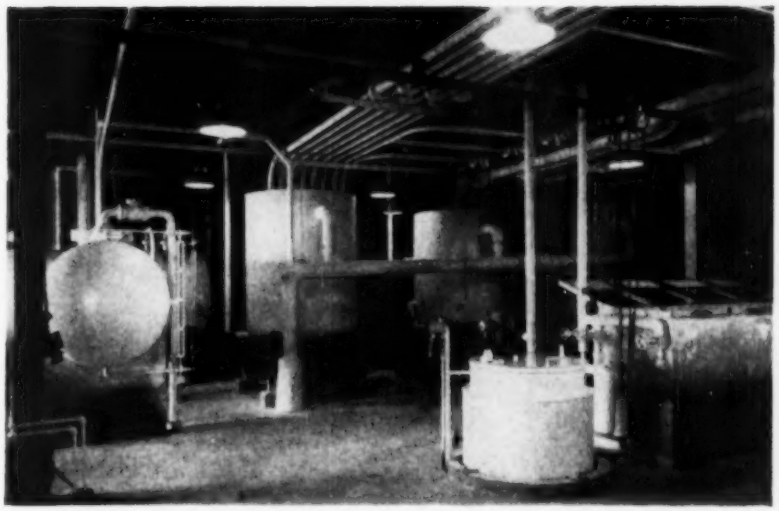


Figure 3. All weighing tanks are equipped with high and low level alarms and can be remotely controlled.

product. Then it is pumped from the kettle thru the mill where it is homogenized, then thru the deaerator where air and moisture are removed to the desired extent before packaging.

The cycle for sodium grease as described above, usually takes slightly less than two hours and is sufficient for the 15,000-pound kettle operation when the grease is packaged in large containers. Of this time, the contactor is used slightly less than one hour for the batch. To make the desired production rate of 60,000 pounds per day, it is necessary to make less than two full batches per day in each of the three main kettles. The contactor will be in operation as required to produce the soap and to disperse soap and oil when desired. For the production of certain special greases, the contactor may occasionally not be used.

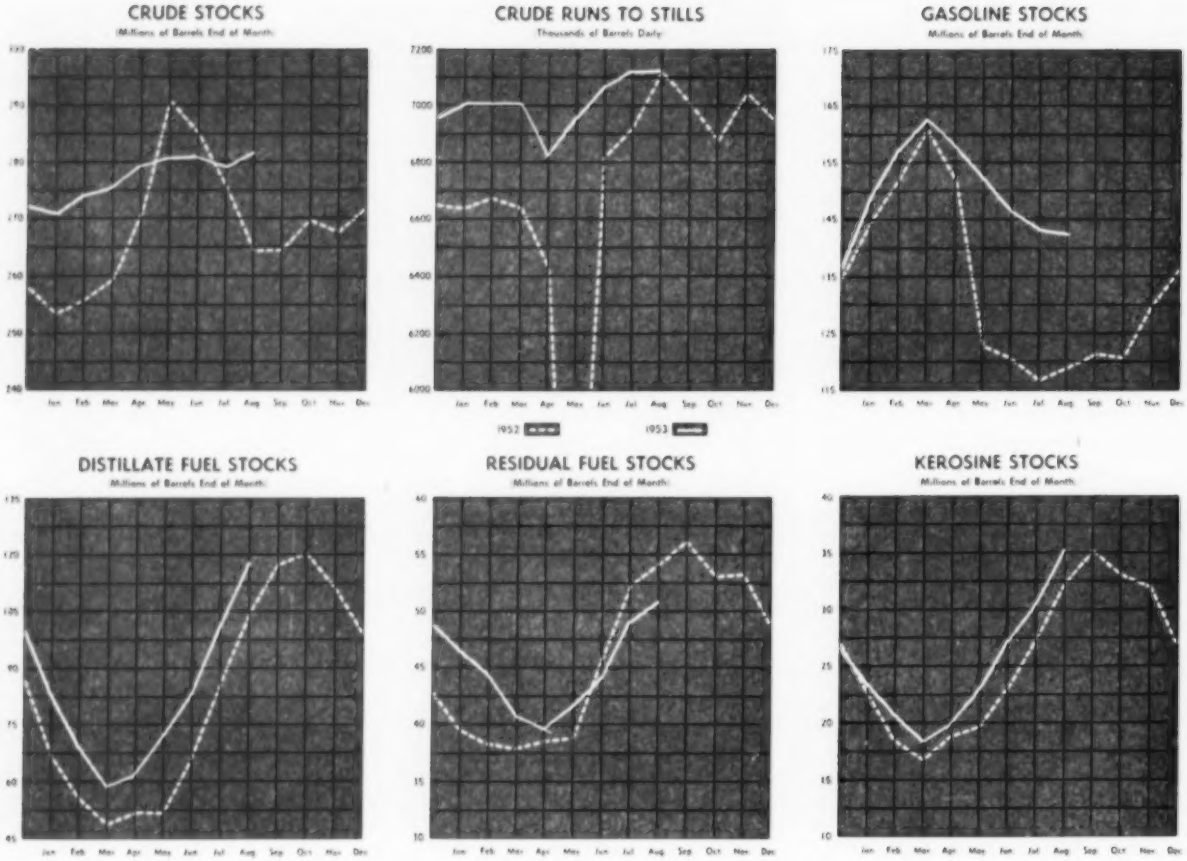
Heating of the kettles and the contactor is by means of hot oil at 450-500 F. pumped thru each vessel jacket at rates of 200 to 300 gpm. The oil furnace has a small radiant section, a tubular convection section and an air preheater.

The hot oil circulating pump sends the jacket oil thru the furnace and into a surge drum. From there the jacket oil pump sends the oil to the heating jackets from which it returns to the surge drum.

The control panels, conveniently located on the second floor, adjacent to the contactor, kettles and inside storage tanks, are equipped with nine recording temperature controllers. These instruments allow the operator to control remotely the temperatures of liquid fats and oils when being charged thru weigh tanks to any one of the kettles or the contactor. An additional recording temperature controller gives automatic control of the temperature of the circulating heating oil. Temperatures thruout various sections of the process may be checked by means of a conventional multipoint potentiometer while the kettle and contactor temperatures can be observed on a four-point recorder. Instrumentation of this type, where temperature records are available for each batch of grease, results in economy of operation as well as uniformity of product.

The grease plant is almost completely self sufficient with respect to laboratory services. The laboratory within the grease plant building is fully equipped and staffed for control testing and development work. Testing equipment is provided for performing all important tests common to the grease industry. Adjoining the laboratory is the pilot plant room. The pilot plant is, in reality, a small scale production unit with a capacity of 400 pounds, and is capable of duplicating, on a reduced scale, all operations of the full scale plant. Equipment includes, in addition to the contactor and kettle, a miniature colloid mill and vacuum dehydrator-deaerator. It is possible, therefore, to develop formulations and most efficient process conditions when making use of the pilot plant. Prior to the completion of the grease plant building, the pilot plant was set up in a temporary building and operated for several months to develop the formulations which are now being used in the grease plant proper.

The design of this plant was carried out thru the joint efforts of F. A. Davis, R. O. Rinearson and D. E. Caldwell of The British American Oil Company, Ltd. and the Engineering Staff of The C. W. Nofsinger Company.


CRUDE STOCKS
Millions of Barrels End of Month
CRUDE RUNS TO STILLS
Thousands of Barrels Daily
GASOLINE STOCKS
Millions of Barrels End of Month
DISTILLATE FUEL STOCKS
Millions of Barrels End of Month
RESIDUAL FUEL STOCKS
Millions of Barrels End of Month
KEROSINE STOCKS
Millions of Barrels End of Month
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1952
1953

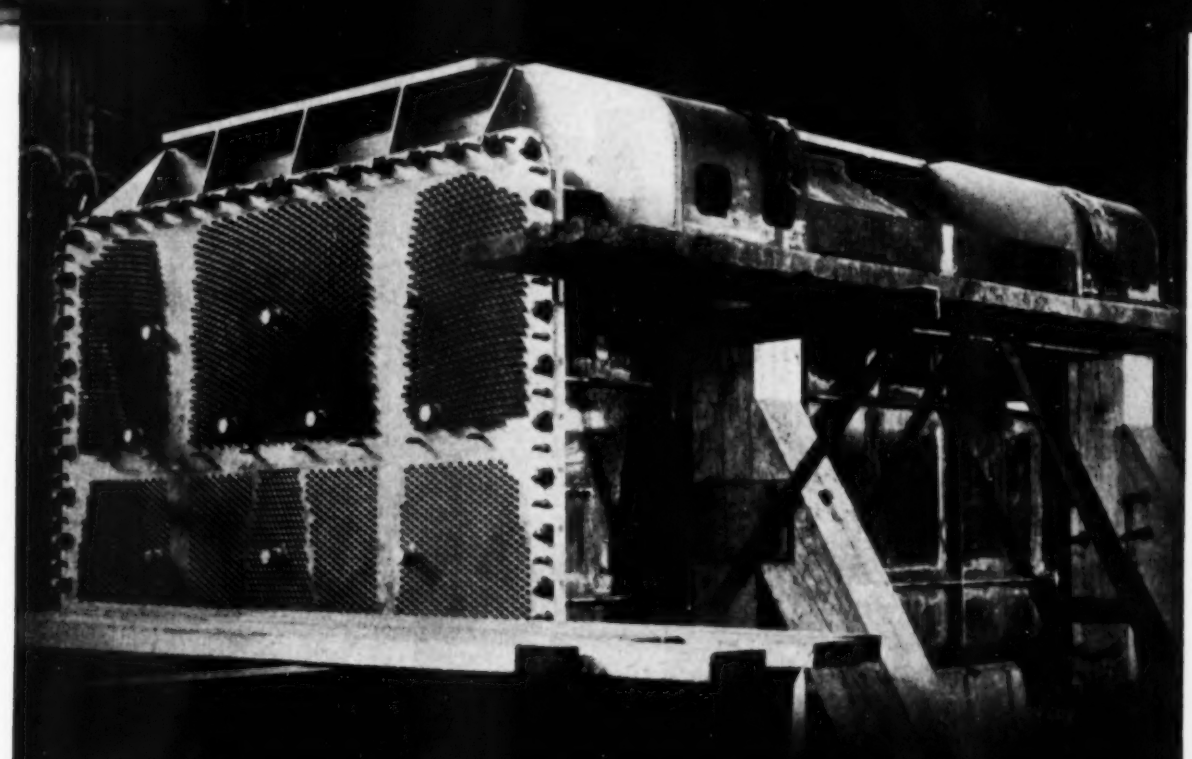
Taking Stock

Cecil W. Smith
Economics Editor

(DATA IN THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		KEROSINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1952:													
February	6,367	6,673	255,900	3,109	151,912	370	18,530	1,528	55,369	1,322	38,295	491	940
March	6,388	6,640	259,126	3,069	160,689	386	16,817	1,400	48,750	1,274	37,971	510	947
April	6,429	6,435	270,679	2,995	151,890	366	18,955	1,312	51,634	1,253	38,561	539	922
May	5,107	4,905	290,813	2,295	123,656	229	19,614	982	51,648	979	38,821	545	951
June	6,197	6,825	285,964	3,169	120,166	317	23,061	1,455	65,911	1,228	45,688	581	901
July	6,093	6,927	275,951	3,295	116,566	358	27,387	1,475	85,775	1,237	52,245	597	892
August	6,219	7,118	264,368	3,377	118,592	375	32,401	1,514	104,257	1,252	54,061	632	879
September	6,518	7,017	264,723	3,428	120,991	350	35,021	1,502	117,252	1,230	56,200	615	902
October	6,518	6,883	269,776	3,301	120,062	352	33,289	1,458	120,721	1,203	53,052	643	1,038
November	6,487	7,049	267,852	3,416	129,509	393	32,199	1,510	116,096	1,269	53,069	624	984
December	6,634	6,952	271,928	3,361	136,028	421	26,842	1,509	99,582	1,302	48,706	603	1,165
1953:													
January	6,555	7,042	272,250	3,384	150,518	433	23,292	1,528	80,655	1,307	45,910	616	1,135
February	6,562	6,969	273,589	3,379	157,873	404	20,468	1,505	67,167	1,275	44,178	586	1,066
March	6,531	7,002	275,665	3,319	162,731	359	18,697	1,489	59,802	1,256	41,600	655	1,112
April	6,446	6,781	280,487	3,282	158,032	361	20,335	1,424	61,349	1,219	39,572	628	1,010
May	6,390	7,002	280,308	3,366	156,415	327	24,307	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	326	27,659	1,462	84,504	1,238	43,801	707	1,050
July	6,528	7,120	279,140	3,530	143,426	333	30,672	1,463	102,003	1,256	49,453	603	890
August	6,588	7,128	282,287	3,571	143,162	320	35,061	1,452	118,158	1,233	50,946	673	926
August, 1953—Change:													
In Month	+60	+8	+3,147	+41	264	−13	+4,389	−11	+16,155	−23	+1,493	+70	+36
In Year	+369	+10	+17,919	+194	+24,570	−55	+2,660	−62	+13,901	−19	−3,115	+41	+47
Week Ended:													
9-19-53	6,495	6,992	283,577	3,527	143,740	306	37,358	1,401	126,189	1,218	52,164	699	1,088
9-20-52	6,518	7,075	264,466	3,426	118,315	390	34,680	1,468	112,472	1,218	53,484	661	933

Source: Data for last two months from API; prior monthly data from Bureau of Mines.



It will pay you as it has paid others to

Specify Revere

CONDENSER TUBES AND PLATES

It is significant that year after year important users of condenser tubes and plates specify Revere, not only for new equipment, but when re-tubing. You might consider this fact if you are not as yet a Revere customer.

Remember that Revere can give you more than tubes and plates. If you have questions regarding the most suitable alloy to meet operating conditions, the Revere Technical Advisory Service will be glad to collaborate with you on this subject. If your present tubes do not seem to be giving the service expected of them, the same Service will look into the matter. Such factors as vibration, air entrainment, water velocity, impingement attack, changed water conditions, tube composition, and others will be studied and recommendations made. In a great many cases we have pointed the way to greater tube economy, increased service life.

As part of our service to condenser operators we have prepared a 28-page booklet entitled "Life Extension for Condenser Tubes." Ask for it on your company letterhead and it will be sent free.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

Meet Our **Authors . . .**

Hamilton Lenoir White Newton Mason Metcalfe

Lenoir and **White** Have Activities in Common

J. M. Lenoir and Gerald A. White, "Vapor-Liquid Equilibrium Ratios," page 121.

Two things which J. M. Lenoir and Gerald A. White have in common, among other things, are that they are both instructors and both have been employed by C. F. Braun & Company, Alhambra, Calif.

Lenoir, who has a background of academic and industrial experience, is chairman of the Chemical Engineering department at the University of Denver. His professional field of specialization is prediction of physical properties. Prior to his present post, he was associate professor of chemical engineering at the University of Arkansas. His industrial experience was obtained at Braun and at Pan American Refining Corporation.

White has been with Braun since 1947. His fields of activity have been unit operations and heat transfer, and fluid flow. He is currently in process studies and evaluations. Concurrent with his present Braun work he teaches heat transfer part-time in university extension classes. A 1942 graduate of the University of California, M.S. degree in physical chemistry, he was employed by The Dow Chemical Company from 1942 to 1947, at Midland, Mich., and at Torrance, Calif.

White is very emphatic about his hobbies and interest: his two active daughters, 5 and 6, who "have interests and intensions, I believe, in becoming ballplayers, swimmers, and cowboys or Indians."

Hamilton Unlucky in Galveston Fish Search

J. P. Hamilton, "Economic Analysis in Petroleum Refining," page 102.

Since receiving a B.S. degree in chemical engineering at Rice Institute in 1939, J. P. Hamilton has been employed in the Technical Service division at the Baytown, Texas, refinery of Humble Oil & Refining Company. His first five years at Baytown were spent in technical service type work on plant cracking and polymerization operations, the subsequent time in economics and cost analysis work related to the various phases of refinery operations.

Hamilton spends his leisure time "unsuccessfully looking for shrimp and speckled trout in Galveston Bay."

Hoyt Sherman Reeve

Georgia Tech Crew Includes Two Texans

Wm. Meese Newton, T. Brooks Metcalfe and J. W. Mason, "Is Packed Height a Variable in Flooding?" page 125.

This writing trio is connected with Georgia Institute of Technology: Newton as professor of chemical engineering; Metcalfe as a candidate for a Ph.D. degree and Mason as dean of Tech's engineering school.

Newton, a Texan born in Dallas, holds B.S., M.S., and Ph.D. degrees in chemical engineering from the University of Iowa. He has served as chemical engineer for the Tennessee Valley Authority and for Union Oil Company of California. He has also served as associate professor of chemical engineering at the University of Texas.

Metcalfe, another Texan, received B.S. and M.S. degrees in chemical engineering from the University of Texas. Between receiving his M.S. and moving to Georgia Tech for graduate study he worked two years at the Bureau of Industrial Chemistry at Texas. Between his B.S. and M.S. he was with The Dow Chemical Company for two and a half years and with the Naval Reserve as an engineering officer for two years. Concurrent with his entering Georgia he was employed by the State Engineering Experiment Station there. He is now in the Research department of Shell Oil Company, Houston.

Dean Mason received his B.S. degree in chemical engineering from the University of Louisville, his doctor's degree from Yale. His many years of practical experience include work with Girdler Corporation, Palmer Asbestos and Rubber Corporation, and the Connecticut State Water Commission. He became Dean in 1948.

Reeve Qualified to Talk on Health in Industry

B. B. Reeve, "The Problem of Alcoholism in Industry," page 244.

Dr. Reeve is eminently fitted to speak out on all problems related to industry health. A native Indianan, he received a B.S. degree in 1919 and an M.D. in 1921 from the Indiana University School of Medicine, with time out to serve as a hospital apprentice in the Navy during World War I. He interned at Passavant Memorial Hospital of Chicago in 1921-22, practiced surgery in Malvern, Ark., for a year, and in 1923 joined Standard Oil Company (Indiana) as a physician in Whiting's First Aid Hospital.

Dr. Reeve is one of the most "biographed" medical men in the oil industry. His activities are detailed in *International Who's Who in World Medicine, Who's Who in Industrial Medicine, Who's Who in the Central States, Who's Who Among Physicians & Surgeons, Who's Who in Chicago and Vicinity, Who's Who in Industrial Medicine & Traumatic Surgery, The Physician Throughout the Ages—Vol. I, Biographical Encyclopedia of America,* and *Who's Who in World Medicine.*

Here's what he does with his spare time: member of The American Petroleum Institute Medical Advisory Committee; chairman of the Health Committee, Petroleum Section, National Safety Council; member and fellow, American Medical Association; member, Chicago Medical Society; member, Illinois State Medical Society; member, Central States Society of Industrial Medicine & Surgery; Fellow, Industrial Medicine; member, Chicago Section of American Industrial Association; and member, American Industrial Hygiene Association.

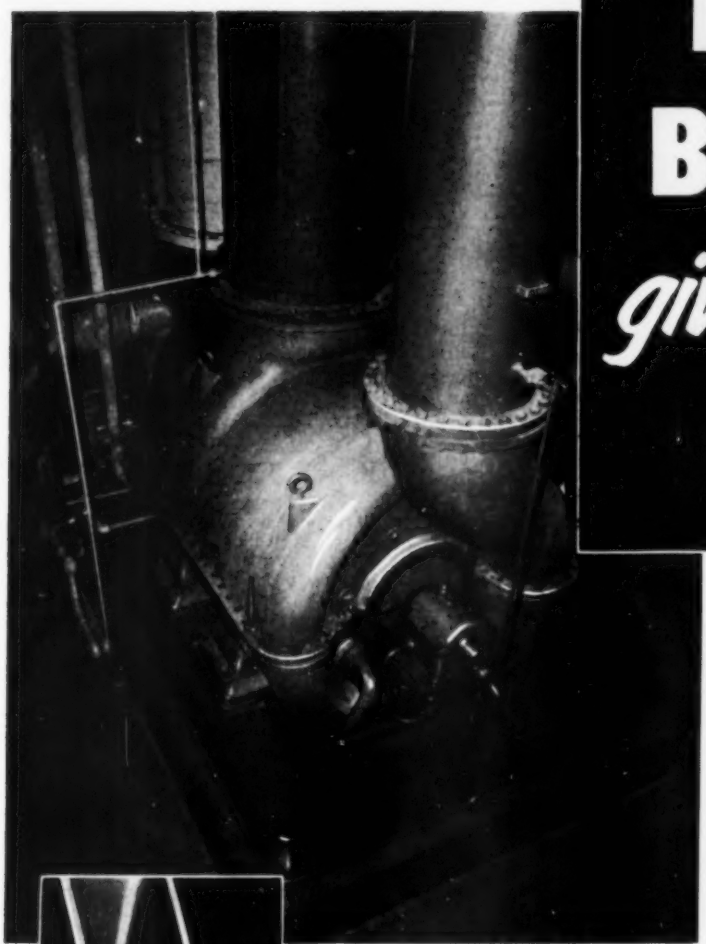
Hoyt and **Stanton** Look at Process Control Systems

Paul R. Hoyt and **Ben D. Stanton,** "Analyzing Process Control Systems," page 115.

This writing twosome is associated with Shell Development Company, Paul Hoyt as assistant department head of the Instrument department and Ben Stanton as an instrument engineer.

For Stanton his job with Shell is a slight shift in a familiar field. Before graduating from the University of California and subsequent employment with Shell he held two non-professional jobs in instrumentation: 1) instrument me-

ELLIOTT BLOWERS *give marathon service*



WELDED IMPELLERS *are one of the many reasons why Elliott blowers are getting ever-increasing acceptance for process work. Note the smooth contours, heavy blades, and generally rugged construction (as compared to conventional riveted impellers). These impellers are completely homogeneous and can be made of any weldable material having reasonable mechanical strength.*

CONTINUOUS AND RELIABLE performance is an established characteristic of Elliott centrifugal blowers. This is proven in numerous modern refineries where large quantities of air are required for conveying and regenerating catalyst.

The blower installation pictured is typical. Serving an important midwest refinery, it is rated at 30,000 inlet cfm, compressing air to a discharge pressure of 26 psig. Day and night this blower is driven at 4750 rpm by an Elliott direct-connected 3140-hp condensing steam turbine.

For full details of Elliott blowers, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

CENTRIFUGAL BLOWER DEPARTMENT

P3-6

Meet Our **Authors . . .**

Rinearson | Nofsinger | Weaver | Gilkeson | Harang | Ruthruff

chanics at Standard Oil Company of California's El Segundo refinery, and 2) senior instrument technician at North American Aircraft Company.

Hoyt, whose parents were missionaries, was born in Cherokee, Okla., and spent 12 of his early years in Kenya Colony, East Africa. A graduate of Friends University in 1931 with a degree in physics, he continued his study of physics, resulting in an M.S. degree at Kansas State College of Agriculture and Mechanical Sciences, Manhattan.

From 1932 to 1934 he worked at Derby Oil Company's Wichita, Kan., refinery, starting as an operator on the Dubbs units and later serving as an instrument man. It was as an instrument man that he joined Shell Oil Company's Arkansas City refinery. In 1938 he was transferred by Shell to its Norco, La., refinery as instrument foreman, and again a year later to its Wood River, Ill., refinery as instrument engineer.

Rinearson and **Nofsinger** Explain Grease Plant Job

R. O. Rinearson and C. W. Nofsinger, "Modern Grease Plant Goes on Stream," page 155.

In the 23 years following his graduation from the University of Oklahoma, where he studied analytical chemistry, Roy O. Rinearson engaged in practically all phases of grease manufacturing. In addition to 11 years on the staff of a large refinery at Muskogee, Okla., he was for four years in charge of the complete grease operation for another major Oklahoma refinery.

Rinearson's background was exactly the kind required by British American Oil Company in 1951. British American's Clarkson grease plant was approaching the blueprint stage. Rinearson joined British American in 1951.

On the Clarkson plant job, Rinearson worked with The C. W. Nofsinger Company, president of which was and still is Charles W. Nofsinger. Upon graduating from the University of Illinois in 1922 with a B.S. degree in mechanical engineering, Nofsinger joined Sinclair Refining Company. He left Sinclair in 1926 to go with The M. W. Kellogg Company, with whom he remained until 1944. During the war, he was chief technologist, Refining division, Petroleum Administration for War. From 1945 to 1950 he was retained as consulting engineer by Sinclair Development Company and Stratford Engineering Corporation. Since 1950 he has been president of The C. F. Nofsinger Company.

Sherman Started Out as College Instructor

Jack Sherman, "Physical Data on Hydrocarbons," page 145.

California-born Jack Sherman has been with The Texas Company since 1940, except for a one-year period 1943-44 during which he was with the National Defense Research Committee. Since 1947 he has been a mathematician.

He received his B.S. degree in chemistry from the University of California in 1929, his Ph.D. degree in chemistry from California Institute of Technology.

Upon obtaining his Ph.D. degree, Sherman joined the faculty of Cal Tech as assistant in chemistry, Gates Chemical Labs, leaving after four years to teach at Pennsylvania State College. After two years at Penn State he transferred to Cornell University a short time before becoming a physical chemist at Universal Oil Products Company. His next position was with Texaco.

Weaver and **Gilkeson** For Student-Prof Team

Robert E. Weaver and Mack Gilkeson, "Asphalt Quality Test," page 153.

Born in New Orleans, Robert Weaver received a B.S. degree in chemical engineering from Tulane University of Louisiana, where he is presently studying towards an M.S. degree in the same subject. He is a junior member of AIChE and ACS. In his leisure time he sings with the Tulane Glee Club and serves as summer camp counselor in Michigan, where he enjoys outdoor sports. His hobbies include philately and chess.

Mack Gilkeson, a Kansan, is an associate professor at Tulane. He holds chemical engineering degrees from the University of Southern California, B.E.; Kansas State College of Agriculture and Applied Sciences, M.S.; and the University of Michigan, Ph.D. He also has received an M.S.E. degree in metallurgical engineering from the University of Michigan. He lists his hobbies as chess, sports (mainly as an observer), and listening to high-fidelity recordings.

Harang Acquainted With Many Chemical Processes

R. A. Harang, "The Mechanical Design of Fluid Hydroforming," page 135.

A native New Yorker, Richard A. Harang received a B.S.E. degree in chemical engineering from the University of Michigan in May, 1943, immediately after which he went into the U. S. Navy.

Out of the Navy in 1946 he joined his brother in forming Harang Engineering Company in San Francisco before returning to the East.

He began with The M. W. Kellogg Company that same year as a design engineer in the Heat Transfer division, moving to the Project Engineering department as job engineer two years later. At Kellogg he has worked with such chemical processes as delayed coking, propane deasphalting, catalytic cracking, and catalytic polymerization. He is married and has two children.

Ruthruff Got Degrees In Quick Succession

Robert F. Ruthruff, "Compare These Four Methods for Making Phthalic Anhydride," page 113.

This consulting chemist and chemical engineer received his B.S. and M.S. degree in chemistry and his Ph.D. degree within three years, all at the University of Michigan. After receiving the Ph.D. in 1927 he joined E. I. du Pont de Nemours and Company as a research chemist. He left du Pont in 1928 and was in succession in charge of experimental cracking and high pressure research at Standard Oil Company (Indiana) technical assistant to the president in charge of engineering and development at The M. W. Kellogg Company, and director of research at The Sherwin-Williams Company. After nine years with Sherwin-Williams, he left in 1948 to become a consulting chemist.

Bottomley Adds to Long List of Activities

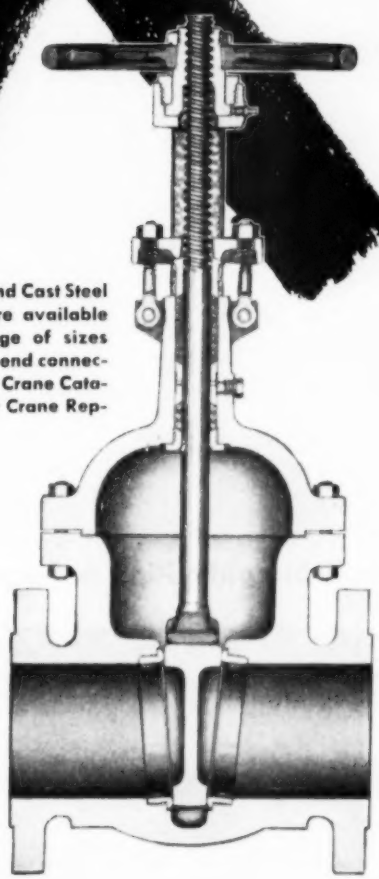
Harold Bottomley, "Definitive Cost Estimating," page 110.

Readers of PETROLEUM REFINER last month will recognize immediately the name of Harold Bottomley, who authored for that issue "How to Prepare Cost Estimates." Harold Bottomley is also familiar to numerous people in the industry. In 25 years as chemist, draftsman, chemical engineer, senior petroleum specialist, chief engineer and in various other capacities, he saw and participated in a great deal of industry progress.

Since March of this year Bottomley has had his own petroleum process consulting service in Tulsa, adding still another notch to his long skein of activities.

X Marks a BIG Difference

IN 300-POUND STEEL GATE VALVES



Crane 300-Pound Cast Steel Gate Valves are available in a wide range of sizes with 3 different end connections. See your Crane Catalog or call your Crane Representative.

There's a lot of pioneering wrapped up in Crane 300-Pound Cast Steel Wedge Gates—pioneering that helped set the high quality standards every modern steel valve must meet.

Take Crane *Exelloy*—"X" trim—for example. In the early days of oil refining, many metal and metal combinations were tried for seating surfaces and found wanting. Crane *Exelloy*, adopted more than 25 years ago, set a new record of usefulness and satisfaction. So remarkable was its performance that this class of material (roughly designated as 11½ to 13 per cent chrome) became the recognized staple valve trim in the petroleum industry.

And yet, Crane still manages to come up with "X" trim of superior quality. It's done with bars and billets that meet the most rigid specifications—and manufacturing techniques that develop the best characteristic of material for each component part.

And it's you, the Thrifty Valve Buyer, who benefits from Crane Co.'s pioneering experience. You get better quality steel valves—quality that keeps up performance and holds down maintenance costs.

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

How to **Do It . . .**

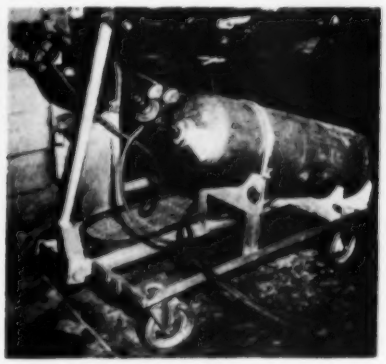
Test Stand Uncovers Leaks

Repaired valves should be checked before reinstallation, not after. This unit makes checking for leaks accurate and simple.

AFTER VALVES have been repaired, there is always the chance that something might have been overlooked which would prevent the valve from functioning properly. The time to find out is before the valve has left the repair shop, not after the valve has been placed in service and the equipment put on stream.

The test stand shown in the picture is one method for testing valves. In this instance it is located at the repair shop. The essentials of this test stand are a manually operated hydraulic pump, a pressure gage, and several sizes of flanges and threaded fittings. The entire hydraulic system uses ¼-inch pipe. Valves are placed in the hydraulic system so that pressure can be applied to the desired test point on the stand. Both flanged valves and valves for screwed lines can be tested.

After the valve to be tested is fixed in place on the stand, the operator lines up the hydraulic system to apply pressure at that point. He then uses the pump as shown to build the desired test pressure. When the test pressure has been attained, he can check for leaks by observing the gage to see if the pressure remains steady.



Welding Cylinder Cart **Keeps Equipment Handy**

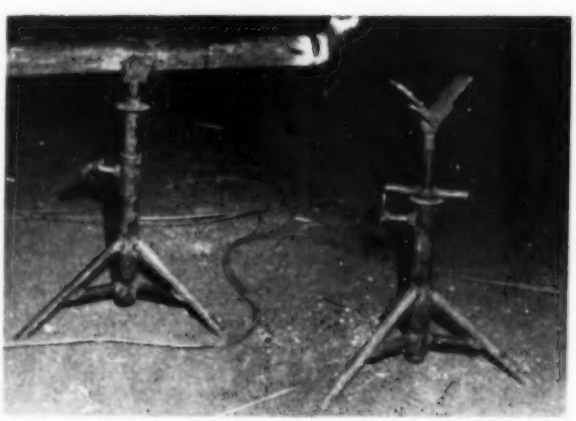
If there is a need to make acetylene welding and cutting equipment portable, the cart shown will do the job. Although designed primarily for moving the cylinders around the shop, it could easily be used to carry the cylinders out to the job in the field.

The frame is made of 2-inch angle iron welded together so that three rectangular openings are formed. Over each of the outside openings, supports are made from angle iron and sheet metal for the oxygen and acteylene cylinders. A section of grating placed in the center opening of the frame makes a walkway wide enough for a man to walk between the cylinders. The 6-inch rubber-tired wheels and their assemblies are welded to ½-inch plates, six inches square, in each corner of the frame. The tongue of the cart is made of scrap iron and pipe.

Note that the box under the oxygen cylinder can be used to store torches and auxiliary equipment and is equipped with a padlock.

Adjustable Stands **Simplify Pipe Fabrication**

Pipe stands come in all sizes and shapes. Here is a couple of varieties which are easy to make and offer lots of flexibility in adjusting them to the desired height.

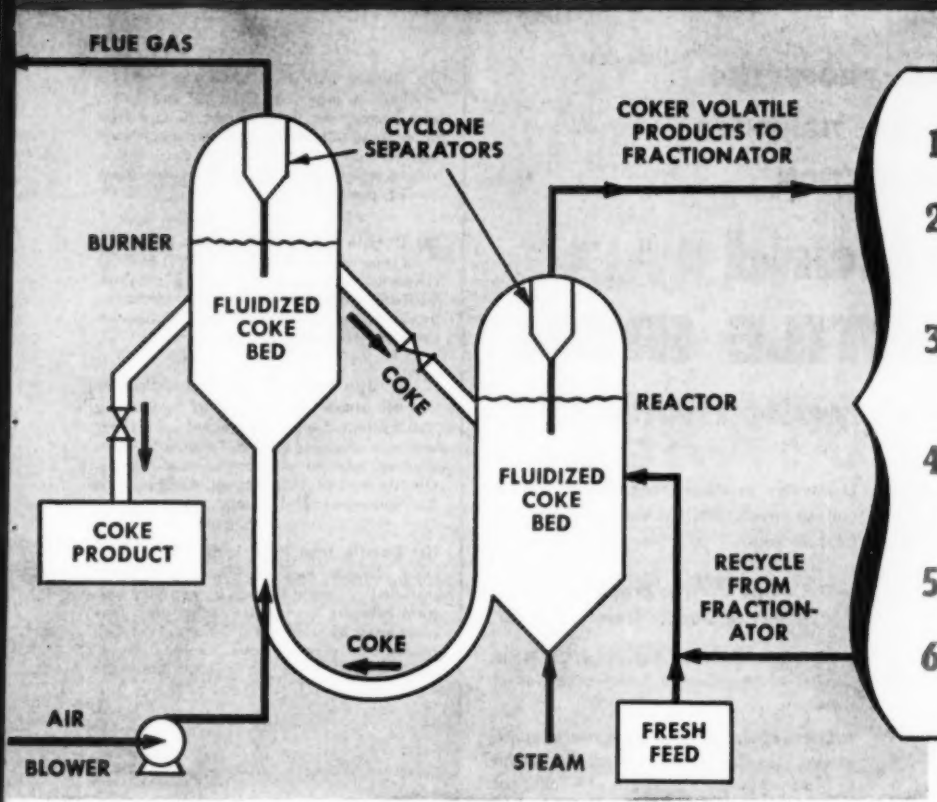


Both use the same basic tripod stand. The stands have a 1½-inch pipe fitting into the 2-inch pipe used in the base. Rough adjustment of height is made by lifting the 1½-inch pipe and then clamping it into position with the screw mounted on the side of the 2-inch pipe.

Final adjustment is made by means of the threaded rod inside the 1½-inch pipe. As indicated in the picture this final adjustment is handled in a slightly different fashion on each stand.

FLUID COKING*

offers you these advantages



1. **Continuous operation**
2. **Broad flexibility of both feed and products**
3. **Higher ultimate gasoline yield**
4. **Residual products yield reduced to a minimum**
5. **Low plant investment**
6. **Economical operation**

* *Licensed by Standard Oil Development Co.*

McKee Engineering Assures You Correct Plant Design

MCKEE services assure you a Fluid Coking plant designed and constructed to obtain fullest advantages of this new process.

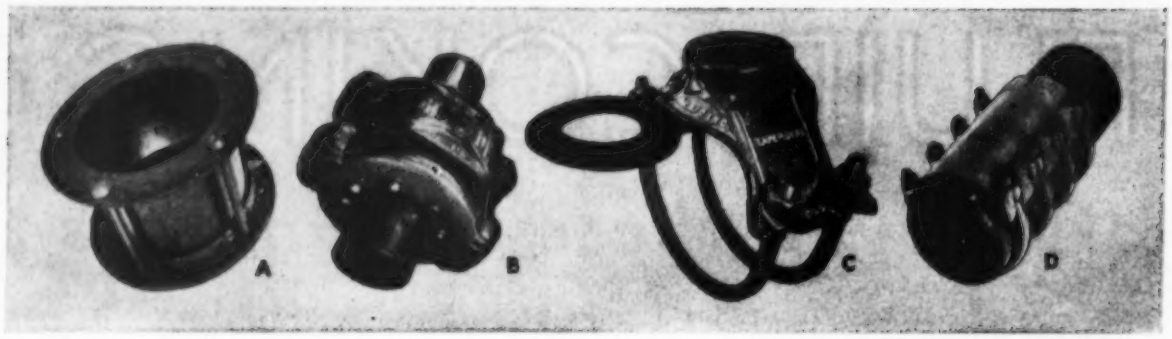
MCKEE Company's enlarged process engineering facilities, design, engineering, purchasing and construction services are backed by a long, successful record on all types of refining facilities.

For Fluid Coking, as for all the other refining processes, you can depend on it—*McKee Engineering means Assured Results.*

ENGINEERING, PURCHASING AND CONSTRUCTION FOR THE PETROLEUM REFINING AND IRON AND STEEL INDUSTRIES

Arthur G. McKee & Company • Established 1905

Headquarters: McKee Building, 2300 Chester Avenue, Cleveland 1, Ohio.
Offices: New York • Tulsa, Oklahoma • Union, New Jersey • Washington, D. C.
British representatives of Metals Division: Head, Wrightson & Company, Ltd.
Canada: **Arthur G. McKee & Company of Canada, Ltd., 350 Bay St., Toronto 1, Ont.**



- **HIGH MECHANICAL PROPERTIES**
- **SUPERIOR PRESSURE TIGHTNESS**
- **ECONOMICAL PRODUCTION**

widen demand for DUCTILE IRON

in pipe line applications

DUCTILE IRON . . . a revolutionary metallurgical development . . . combines the process advantages of cast iron with the product advantages of cast steel.

Tensile strength of DUCTILE IRON greatly exceeds that available in gray iron. Values in excess of 150,000 psi may be attained by heat treatment. DUCTILE IRON parts resist permanent deformation at higher pressures because of their higher yield strength.

Superior pressure tightness is available in DUCTILE IRON because of its metallurgical structure. Therefore, fittings withstand higher hydrostatic pressure before leakage occurs.

DUCTILE IRON parts can be economically produced because of its excellent machinability and its ability to be cast readily into intricate shapes.

Some Unique Properties of Ductile Iron

1. Its elastic modulus, about 25,000,000 psi, is virtually unaffected by composition or thickness . . .
2. Ductile Iron of 93,000 psi tensile strength, as cast, has the same machinability rating as gray iron with a strength of 45,000 psi.
3. Annealed Ductile Iron can be machined at a rate 2 to 3 times that of good quality gray iron.
4. It can be satisfactorily welded.
5. It resists oxidation and growth to an extent never before available in gray iron castings.
6. It can be cast in intricate shapes not normally feasible for cast steel.

(A) Ductile Iron Flexible Coupling . . . available in pipe sizes from ½" and up . . . with strong yet light weight flanges that prove more durable than those made of cast iron. Special corrosion-resisting finishes provide a connecting unit that assures long-lasting, positive seal.

(B) Ductile Iron H.O.V. Split Coupling . . . a type widely used directly over existing couplings on pipe lines carrying gasoline. Utilizing both mechanical and hydraulic pressures for sealing, this type withstands pressures exceeding 1300 psi.

(C) Ductile Iron "Tapping Saddle" or Double Strap Service Clamp . . . showing Smith-Blair design designated as "taper seal" . . . available in 2" to 20⅛" O.D. sizes. Utilizes internal pressure to seal tightly. Ductile Iron provides strong, durable, flexible and economical clamp.

(D) Ductile Iron Pipe Leak Clamp . . . rigid, durable, very economical and easily installed . . . stops leakage by applying uniform pressure over entire gasket area. One piece may be used with U-bolts . . . or two pieces, with carriage bolts. Available for 4" to 12¾" O.D. pipe, and in length multiples of 3" up to 12".

Shown here are examples of pipe line equipment designed and manufactured by Smith-Blair, Inc., of South San Francisco, utilizing Ductile Iron castings produced by the Vulcan Foundry Company of Oakland, California.

Send us details of your prospective uses, so that we may offer a list of sources from some 100 authorized foundries now producing ductile iron under patent licenses. Request a list of available publications on Ductile Iron . . . mail the coupon now.

THE INTERNATIONAL NICKEL COMPANY, INC.
Dept. 20, 67 Wall Street, New York 5, N. Y. PR-10-53
Please send me a list of publications on: **DUCTILE IRON.**

Name _____ Title _____

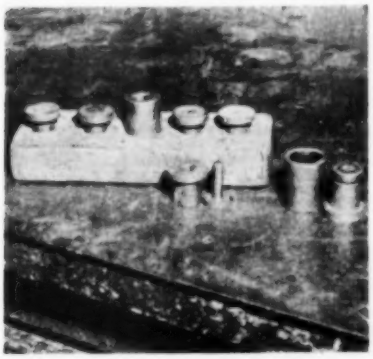
Company _____

Address _____

City _____ State _____

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

How to **Do It . . .**

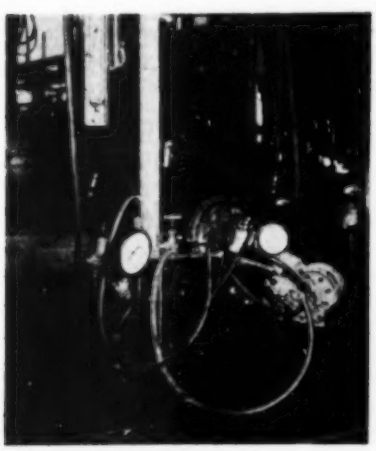


Simply Made Device **Forms Packing Rings**

It is so much easier and faster to form packing rings before they are placed into position than it is to try to form the rings as the valve is being packed.

The picture shows the equipment that can be used to form these rings. Several different sizes are shown which are used for forming the packing in various size valves. The device consists of two parts. Both are made by machining so that the rings will fit as they should in the valve. A piece of solid stock is machined out so that the inside dimensions of the hole are the same as the outside dimensions required for the packing rings. The other part is machined so that its outside dimensions match those of the inside of the rings.

Rings are formed by wrapping the packing around the latter part and then driving the part and packing into the hole of the other part.



Test Block **Checks Gage Accuracy Quickly**

The test block shown is used to obtain a quick check on the accuracy of pressure gages. Both the fittings to which the gages are screwed and the manometers used for checking their accuracy are all mounted on a single stand for convenience.

Pressure to test the gages is supplied

Ready for you after 12 months of brutal

CUSTOMER TESTING!

CLARK's

New and Exclusive

HYDRATORK DRIVE*

Here's how it improves your fork-truck operation:

1. **MORE WORK:** faster get-away, positive power without slippage; moves heavy loads and climbs ramps with ease.
2. **LOWER COST:** higher percentage of "on-the-job" time results from no clutch problems, "cushioning" effect on motor and drive members.
3. **GREATER SAFETY:** hydraulic brake system, linked to torque converter, automatically cuts power; engine cannot be started unless controls are in neutral.
4. **IMPROVES DRIVER EFFICIENCY:** finger-tip direction control and elimination of gear-shifting conserves operator energy.

Not one, but *eighteen* HYDRATORK-equipped trucks were placed in customers' plants for a full year of on-the-job testing. Without exception, these units proved that reduction in driver fatigue and of truck downtime results in greater production from HYDRATORK-equipped trucks.

1903 CLARK EQUIPMENT

* *Now available in 6-7000 lb. capacity truck*

Mail the coupon for detailed literature which explains how CLARK's new and exclusive HYDRATORK DRIVE operates.

CLARK ELECTRIC, GAS, DIESEL, LP GAS **FORK TRUCKS**
AND POWERED HAND TRUCKS : INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIVISION • CLARK EQUIPMENT COMPANY • BATTLE CREEK 161, MICHIGAN
Please send: ☐ Hydratork literature ☐ Condensed catalog
☐ Have representative call
Name _____
Firm Name _____
Street _____
City _____ Zone _____ State _____

AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

Wilgus **NGE**
DESIGNED...

TO GIVE YOU
Greater Sensitivity - Greater Reliability

Double your Valve Efficiency with MAGNA-STROKE ACTION Available in all Wilgus NGE Regulating Valves

DIAPHRAGM ACTUATED MOTOR VALVES

★ ***Sensitivity:***
Moulded Neophrene diaphragms responsive to minute loading pressure change of control instrument.

★ ***Flexibility:***
Valve action is reversible in field with no additional parts.

★ ***Reliability:***
All valves top and bottom guided.

★ ***Quality:***
One piece packing glands.

★ ***Simplicity:***
All valve bodies are interchangeable with all diaphragm assemblies. Easily accessible for maintenance.

★ ***Ruggedness:***
Available in materials to suit every requirement. Quality construction for years of maximum service.

★ ***Versatility:***
All diaphragm casings fit the standard spring case and yoke.

★ ***Standardization:***
All flanged valves have Instrument Society of America standard FACE-TO-FACE dimensions.

FULLY DESCRIBED IN BULLETIN 612
Write for your free copy today

Sold Nationally by
Natural Gas Equipment, Inc.
190 East Glenarm St., Pasadena, Calif.
Available from
Automatic Specialties Co., Pittsburgh, Penna.
Gulf Coast Machine & Supply Co., Houston and Beaumont, Texas

by the instrument air system. The block is manifolded so that the same pressure is applied to the gage and the manometers. One manometer uses water as the liquid and the other mercury. After pressure is applied to the system, a check of the manometer reading and the gage reading shows the gage deviation from the true pressure. Several gages can be tested at the same time.

Furnace **Relieves Fabrication Stresses**

Often in the course of fabricating pipe, it is advisable to stress-relieve those sections which may have been affected during the fabricating operations.

This furnace, made primarily from scrap materials, is very useful for doing this job. The furnace proper is made from sheets of ¼-inch thick steel. The interior of the upper and lower portions of the furnace is lined with a 3-inch thick layer of insulation spread over metal grating to hold it in place. A section of 6-inch pipe welded to one side serves as a stack. Gas-fired burners are welded into place on the opposite side. The upper section of the furnace is hinged along one side.

Semi-circles of various size are cut into both sections of the furnace at each end along the line of contact of the two sections. This enables the furnace to handle long lengths of pipe of several different sizes. These holes are plugged with blanks when not in use. The furnace is 5 feet long, 3 feet wide and about 3 feet high.

This Test Stand **Checks Safety Valves**

Because of their importance in the safe operation of all types of equipment, it is absolutely necessary that safety valves be tested and set at the proper operating pressures. One oil company has solved its problem in handling safety valve testing and setting by using this stand which it designed and constructed.

In the foreground is the test stand. As shown, three different size valves could be tested merely by the choice of the proper size flange mounted on the stand. When testing a valve, it is bolted to the flange and the desired pressure is then supplied to the stand.

In the background can be seen the rod pump which supplies the pressure to the system when water is the testing medium. Also in the background is the surge tank with the pressure gage mounted on it. This tank helps dampen the pulsations of pressure from the rod pump, resulting in a steadier pressure.

Although the equipment is not shown in the picture, the system is equipped to use air pressure for the testing of some types of safety valves.

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

October ★ One of a Series of Interest to the Petroleum Industry ★ 1953

A Million $ a Week for Research

Du Pont spent $52,000,000 for its research program last year. And this sum was exclusive of construction costs for new research facilities.

In spite of its high cost, the Du Pont Company believes research offers the best assurance for long-range job security. New job opportunities are created through the new products it develops.

It also helps to create new market opportunities for many basic raw materials. Petrochemicals are an outstanding example of this and Du Pont buys increasingly larger quantities of them every year.

Du Pont Research Program to Help Refiners Solve Pre-Ignition Problems

Pre-ignition during road operation is a definite obstacle to further improvement in the efficiency of fuel utilization in gasoline engines.

The development of higher compression engines makes the need for a solution to this problem—which possibly exceeds knock in importance—all the more pressing. With the aim of helping refiners overcome pre-ignition through the use of additives, the Du Pont Petroleum Laboratory has already done extensive research.

The laboratory has found that the two most important aspects of the problem are: (1) the tendencies of combustion chamber deposits to glow and cause surface ignition of the charge; and (2) the ability of fuels to withstand ignition by hot surfaces.

Deposit glow can be minimized by certain fuel additives. With future higher compression ratio engines it may also be necessary to improve the ability of fuels to withstand hot surface ignition.

EFFECTIVENESS OF TEL

Glowing deposits, principally those flaky in nature, act as igniters and some hydrocarbons are more sensitive to ignition by these hot deposit particles than others.

However, by raising the octane rating as for example *with tetraethyl lead, the pre-ignition tendency of the gasoline is reduced.*

More complete details on these investigations by the Du Pont Petroleum Laboratory can be obtained from any Du Pont Petroleum Chemicals Division district office. Ask for papers entitled "Pre-Ignition in Automotive Engines" and "An Investigation of Pre-Ignition in Engines."

"Magic Barrel"

40 OUTSTANDING PRODUCTS DERIVED FROM PETROLEUM MAKE UNIQUE PUBLIC RELATIONS PRESENTATION

The "Magic Barrel" *looks* like a 55-gallon oil drum.

But, instead of crude oil, the drum contains a wide variety of *finished* products made from petroleum . . . products used every day in the home, on the farm, in industry and on the highways. All of these have been woven into a unique presentation that shows the tremendous importance of petroleum in our daily living.

PETROLEUM is the important ingredient in all the products shown in this "Magic Barrel" display. Mounted on semi-circular trays, the whole display is built up out of the oil drum in the center.

The display and the talk accompanying it were put together by the Du Pont Petroleum Chemicals Division. The show was designed, however, to be used by oil industry representatives, as a public relations presentation. It is both entertaining and educational. As such it is ideally suited for showings to schools and colleges, civic organizations and luncheon clubs, as well as to employee and customer groups.

FLEXIBLE PROGRAM

The speaker builds his theme of "better living from petroleum products" by displaying and demonstrating the many interesting products found in the barrel. The talk is extremely elastic and can be done in 30 minutes or extended to an hour.

The barrel itself is made of aluminum and split lengthwise into two sections. These are hinged together so that the drum can be opened and used as a lectern by the speaker. There are 16 removable shelves inside the barrel. Each holds a small display of related products. Products can be changed or added at the will of the speaker.

3 BASIC NEEDS

The presentation covers the three es-

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

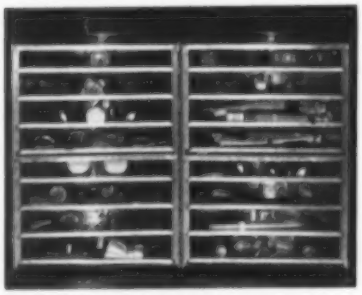
DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *"Magic Barrel"*

sential needs for living: food, clothing and shelter. Protective wrappers, refrigerants, insecticides and weed killers, for example, are all important to food production and distribution.



INSIDE THE "MAGIC BARREL," the trays of products are compactly arranged for convenient shipping.

Synthetic fibers, of course, play an important role in our modern clothing industry. And there are numerous plastics, paints, upholsteries, brushes and

MAKING SYNTHETIC RUBBER right on top of the barrel adds a unique touch of showmanship to the presentation.

other products made from petroleum which are used every day in the home and are included in the display.

The "Magic Barrel" is even a *factory* for making synthetic rubber. Starting with a liquid polymer, rubber balls are produced in a matter of seconds. These are tossed out to the audience as souvenirs.

AVAILABLE TO YOU

If you would like to make use of this presentation in your own public relations program, just get in touch with the nearest Du Pont Petroleum Chemicals Division district office.

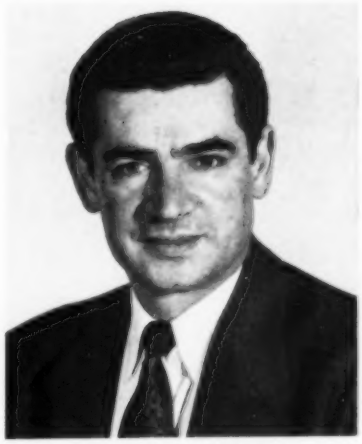
Sales-Service Representative

Arthur C. Santora joined the Du Pont Company in 1950 as a sales-service representative of the Petroleum Chemicals Division's eastern district.

His association with the petroleum industry began in 1943 as a research engineer for the Standard Oil Development Company. During the next seven years his work included research on polymerization, hydrocarbon synthesis, inhibitors, aviation gasoline and a wide variety of petroleum refining problems.

A graduate of Union College with a B.S. in chemistry, Mr. Santora received his M.S. in physics from Cornell in 1940 and his Ph.D. in organic chemistry from the University of North Carolina in 1943. He has also taught mathematics, mechanics and analytical chemistry.

He is a member of the American Chemical Society and the Society of Automotive Engineers.



ARTHUR C. SANTORA

Additive to Improve Diesel Fuels

Du Pont Fuel Oil Additive No. 2, originally developed as a stabilizer and dispersant for distillate fuel oils used in domestic oil burners, also offers a number of advantages to diesel fuel refiners.

Being ashless, it leaves no combustion chamber deposits to cause operating difficulties.

To help refiners gain added flexibility and capacity in diesel fuel production, Fuel Oil Additive No. 2 enables them to blend cat-cracked and straight-run stocks. This additive also allows a certain amount of heavy oil to be blended in the diesel fuel without giving undue difficulties with filterability. In this way, it enables refiners to upgrade their heavy fuel oils.

To prevent clogging of diesel filter screens, Fuel Oil Additive No. 2 not only retards the formation of insoluble residues, but also reduces the particle size of those insoluble residues that are formed.

Storage tests show that in all cases Fuel Oil Additive No. 2 gives best results when added at the refinery to freshly prepared stocks.

LITERATURE AVAILABLE

Here is a partial listing of the bulletins, reports, booklets, technical papers and aids available to you through any of the Du Pont Petroleum Chemicals Division district offices listed below:

Pre-Ignition in Automotive Engines—This paper discusses mainly the glowing tendencies of combustion chamber deposits and the pre-ignition tendencies of individual hydrocarbons . . . . . Serial A-5652

An Investigation of Pre-Ignition in Engines—A comprehensive discussion of how compression ratios and other mechanical factors affect pre-ignition. Also the effect of tetraethyl lead in reducing pre-ignition . . . . . Serial A-5756

Du Pont Fuel Oil Additive No. 2—A 12-page bulletin describing this ashless stabilizer and dispersant which prevents clogging of fuel oil screens. . Serial A-5201

DU PONT

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • *Wilmington 98, Delaware*

District Offices:

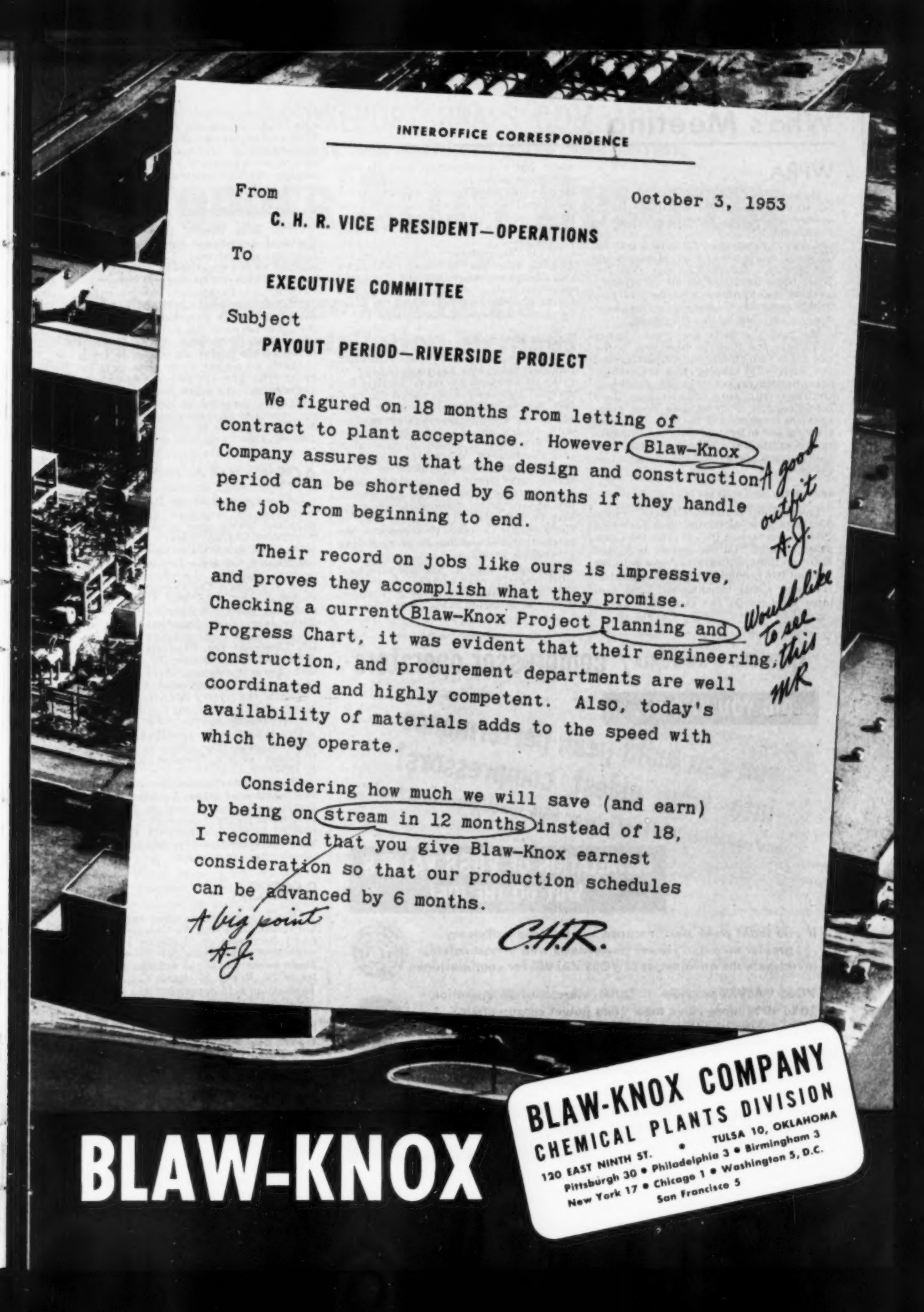
NEW YORK, N. Y.—1270 Ave. of the Americas	Phone COlumbus 5-3620
CHICAGO, ILL.—8 So. Michigan Blvd.	Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue	Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg.	Phone PReston 2857
LOS ANGELES, CALIF.—612 So. Flower St.	Phone MAdison 1691

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-6108

Printed in U.S.A.



INTEROFFICE CORRESPONDENCE

From

C. H. R. VICE PRESIDENT—OPERATIONS

October 3, 1953

To

EXECUTIVE COMMITTEE

Subject

PAYOUT PERIOD—RIVERSIDE PROJECT

We figured on 18 months from letting of contract to plant acceptance. However, Blaw-Knox Company assures us that the design and construction period can be shortened by 6 months if they handle the job from beginning to end.

A good outfit A.J.

Their record on jobs like ours is impressive, and proves they accomplish what they promise. Checking a current Blaw-Knox Project Planning and Progress Chart, it was evident that their engineering, construction, and procurement departments are well coordinated and highly competent. Also, today's availability of materials adds to the speed with which they operate.

Would like to see this MR

Considering how much we will save (and earn) by being on stream in 12 months instead of 18, I recommend that you give Blaw-Knox earnest consideration so that our production schedules can be advanced by 6 months.

A big point A.J.

C.H.R.

BLAW-KNOX

BLAW-KNOX COMPANY
CHEMICAL PLANTS DIVISION
120 EAST NINTH ST. • TULSA 10, OKLAHOMA
Pittsburgh 30 • Philadelphia 3 • Birmingham 3
New York 17 • Chicago 1 • Washington 5, D.C.
San Francisco 5

Who's Meeting . . .

WPRA

Richard R. Crow, director of personnel development for Continental Oil, opened the regional meeting of Western Petroleum Refiners Association in Casper, Wyo., September 24, with a talk on "The Development of Management Leadership." He pointed out that for years there has been an air of mystery on how managers come to be and that beliefs generally held are they "just happen" or are "up to the individual."

He said the facts are much deeper and suggested that the best boss is the one under which the individual learned the most. By tapping this interest in education, managers can be developed through the line organization. Two broad aspects of developing good management leadership in the firm are group training and individual training. For successful group training he maintained that management belief in the program is necessary.

Incentives or Opiates

Questioning seniority clauses in union contracts, Fred M. Butler, director of industrial relations, Cities Service Oil Company, claimed that the worker is incited to do no more than try to hang onto his job until a promotion spot is available. He cited social benefits which he said most workers do not consider extra wages but just something free. He also struck out at the federal government for encouraging this feeling by not taxing the benefits as wages are taxed and termed social security and unemployment insurance acts as the worst opiates to incentive.

W. H. Montgomery, manager of industrial relations for Socony-Vacuum Oil Company, concluded the industrial relations session with a paper on "The Effect of Collective Bargaining on Management-Employee Relationships."

Sinclair Reforming

Discussing the new Sinclair reforming process, John W. Teter, director of catalysis research Division, Sinclair Research Laboratory, Inc., stated the catalyst can be restored to near initial activity by a simple regeneration in place with diluted air. To illustrate the possible flexibility in design, he pointed to two alternatives. When processing a naphtha for production of 80 to 90 research neat octane at operating pressures ranging from 200 to 750 pounds per square inch, continuous reforming may be employed. This design may include simple facilities to regenerate the catalyst at the conclusion of each long processing period.

When operating to produce reformate with research neat octanes above 90 it may be desirable to employ a regenerative type operation. This choice depends to some extent upon the paraffin content of the feedstock. As distinguished from continuous operation, the regenerative scheme of processing embodies facilities to regenerate a portion of the catalyst without interrupting the processing cycle.

Radio Communication

C. L. Rose, general foreman of the electrical department for Standard Oil Company (Indiana), Casper refinery, pointed to the dependency of a maintenance division on its lines of communication. As an efficient medium for contacting supervisors and mobile equipment in his own widespread refinery, the two-way mobile radio was adopted to accomplish the following: (a) reach the supervisor or service truck instantly no matter where they were located; (b) permit two-way exchange information; (c) where more than one craft was involved to permit a semi-conference of all supervisors; (d) enable detailed orders to be given; and (e) not disturb other workers in the community.

ACS

Officers elected by the Petroleum Division of the American Chemical Society and taking their posts at a recent meeting in Chicago were:

Dr. F. D. Rossini, Petroleum Research Laboratory, Carnegie Institute of Technology, chairman; Dr. E. C. Hughes, The Standard Oil Company (Ohio), chairman-elect; J. S. Ball, U. S. Bureau of Mines, Area I representative; R. W. Richardson, Esso Standard Oil Company, Area II representative; V. Haensel, Universal Oil Products Company, Area III representative; W. J. Coppoc, The Texas Company, Area IV representative; A. C. Patterson, Area V representative; Jerry McAfee, Gulf Research and Development Company, Area VI representative.

Dr. Wheeler G. Lovell, Ethyl Corporation, will take office as secretary-treasurer of the Division on January 1, 1954.

The executive committee created a new position of managing editor of preprints and directory and A. G. Oblad, Houdry Process Corporation, was appointed to the post for 1954. Oblad has been secretary-treasurer of the division for the past few years.

RMOGA

Dr. D. J. Bergman, chief engineer of Universal Oil Products Company, led a panel discussion on "Refining Problems—Present and Future" at the sixth annual convention of the refining committee of the Rocky Mountain Oil and Gas Association held September 4 in Billings, Montana.

Panel members talked on these problems confronting petroleum refiners today: Upgrading of straight run gasoline, production of high grade cracked gasoline, disposal of heavy fuel oil and production of aviation gasoline.

Members of the panel were K. E. Dyer, manager, Husky Oil Company, Cody, Wyo.; C. L. Allison, technical director, Socony-Vacuum Oil Company, Inc., Casper, Wyo.; B. D. Nolan, operations analysis supervisor, manufacturing department, the Carter Oil Company, Billings; Ernest Brown, superintendent

AIR • GAS • AMMONIA / compressor operators

DID YOU KNOW...

you can build peak performance into your oldest compressors!

and obviously into your newer, high speed machines, too!

INSTALLATION OF VOSS VALVES WILL DO THE JOB!

if you want peak performance . . . increased efficiency . . . greater output . . . lower power costs with utmost safety, investigate the advantages of VOSS VALVES for your machines.

VOSS VALVES provide. . . Quiet, vibration-free operation • 20 to 60% more valve area • less power consumption • low pressure loss • normal discharge temperature • lower operating costs • utmost safety.

To increase the efficiency of your compressor, send us the name, bore, stroke and speed of your machine. Our detailed proposal will be sent without obligation.

J. H. H. VOSS VALVES REG. U.S. PAT. OFF.

J. H. H. VOSS CO. INCORPORATED

784-A East 144th Street, New York 54, N. Y.

BRIDGEPORT BRASS COMPANY

CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

Bridgeport Brass Co. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. — IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Reduce Premature Tube Failure With Proper Installation Methods

Premature tube failures are often the result of improper installation. Therefore, it is important to re-examine, from time to time, the current practices for installing tubes in condensers and heat exchangers.

Condition of New Tubes

Standard practice these days is to supply brass, aluminum bronze, and cupro nickel tubes sufficiently annealed for complete recrystallization but with fairly small and uniform grain size so that tubes are not too soft for handling. It is not necessary to end-anneal such tubes when they are to be rolled into the tube sheet. Copper tubes usually are made with a 10% reduction (moderately hard), which also can be handled more readily without denting, etc., and can be rolled into the tube sheet without end-annealing.

Installing and Expanding

The inlet ends of roller expanded tubes, as in the case of packed tubes, must be firmly and rigidly held in the tube sheet. If no expansion joint between the shell and a tube sheet has been provided, the discharge ends of the tubes are installed with a packed joint—a combination fibre and metallic packing being generally preferred. When there is an expansion joint, or the tubes are short or the temperature change in service is slight, the tubes can be roller expanded at both ends.

No provision for thermal expansion and contraction is made in most short condensers and heat exchangers. Roller expanding tubes in smooth holes generally is not recommended, particularly where long tubes are used and where the operating temperature is relatively high, as there is no assurance that the tubes will be tight when installed, nor that they will stay tight.

In general, a 5% to 10% reduction in tube wall thickness will give a tight tube in a serrated hole. On the other hand, reduction in wall thickness of 15% or over may cause leaking, split or flaked tubes.

Tightness and Holding Power

To have each tube tight enough to pass the hydraulic test, it is not necessary to "overexpand" tubes in the tube sheet. Expanding or rolling reduces the tube wall thickness but overexpanding may cause corrugations and leaks.

Overexpansion may also leave unrelieved stresses which in time can cause failure by season cracking, which appears as circumferential cracks at or a short distance beyond the tube sheet. "Flaking" of the inside of the expanded section of the tube is caused by overworking the metal. This condition is aggravated by improper lubrication of the expanding tools or by worn rollers and mandrel.

Recommended Diameter of Flared Inlet of Holes in Tube Sheets

O.D. of tube	A	B	C
½"	0.60"	0.38"	0.21"
⅝"	0.75"	0.47"	0.26"
¾"	0.90"	0.56"	0.31"
⅞"	1.05"	0.67"	0.36"
1"	1.20"	0.75"	0.42"

Holes for tubes should be drilled and reamed no more than 0.007" to 0.010" larger than the O.D. of the tubes. For critical conditions even smaller reamed holes may be required. The inside end of these holes should be chamfered 1/16" x 45°. Figure 1 and table give the recommended dimensions of the holes for inlet end

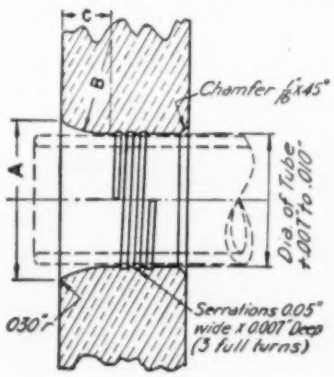


Fig. 1

bell-mouth tube sheets with a bell 20% larger in diameter than the O.D. of the tubes. The preparation of a smooth belled end is done in the interest of keeping turbulence and inlet end corrosion at a minimum. The holes may be serrated with three full helical turns, or two or three individual grooves .005" deep x 0.05" wide. V thread serrations are preferred by some engineers. The serrations should be approximately midway between the chamfer and the beginning of the bell. Serrations materially increase the holding power and tightness of the tubes. Figure 2 shows the recommend-

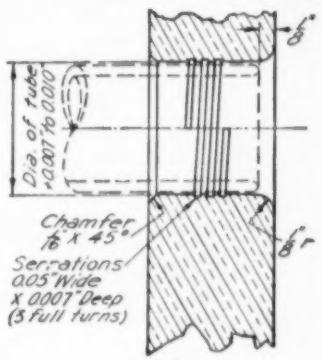


Fig. 2

ed dimensions of the holes in discharge end tube sheets for expanded tubes. The dimensions of holes for packed tubes depend on the type and dimensions of the packing.

Recommended practices for installing condenser and heat exchanger tubes by roller expansion and ferrules are covered in our tube handbook.

Write for Handbook

Our 156-page "Condenser and Heat Exchanger Tube Handbook" contains a detailed discussion of modern installation procedures. It also provides information about Duplex Tubing, condenser tube alloys, various types of corrosion encountered in condenser and heat exchanger tubes, and many suggestions for increasing tube life. Write for your copy.

Technical Service

Bridgeport's Technical Laboratory will be glad to cooperate with engineers, and try to help them arrive at practical, cost-saving solutions to their specific tube problems. (568)

The vise that's a handy portable workbench

RIGID

New No. 40 Tristand Pipe Vise

Easily taken to the job—legs fold in and chain for carrying, tray quickly on and off. Roomy top has pipe rest and efficient benders; tray keeps tools handy—and also makes Tristand extra rigid, won't fold up in use! Tool-steel Longrip jaws—firm grip but easy on polished pipe and tubing. Yoke No. 40, (old TSY-2½) 2½"; chain No. 45 (old TSC-4) 4". Buy these handy worksavers at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO • U. S. A.

RIGID

Work-Saver Pipe Tools

Who's **Meeting . . .**

of laboratory division, Standard Oil Company (Indiana), Casper, and H. A. Brown, vice president, Frontier Refining Company, Cheyenne, Wyo.

NPA

Ways and means to combat corrosion and rust in the multi-million dollar facilities used by the petroleum industry were discussed at the 51st annual meeting of the National Petroleum Association in Atlantic City.

Five experts presented a series of papers on the twin headaches at a symposium sponsored by NPA's Department of Manufacture and Department of Standards and Tests.

F. M. Watkins and R. I. Lindberg, of Sinclair Research Laboratories, Inc., Harvey, Ill., traced the use of corrosion inhibitors in the petroleum industry. They agreed that much progress has been made but that the application of corrosion inhibitors is "still an art rather than a science."

They cited as one example the slushing oils used in World War II, which were quite effective in damp climates where the relative humidity was 100 percent, and less effective when the humidity dropped five to 10 percent. Much of the success of corrosion inhibitors will depend upon the ingenuity of corrosion engineers.

W. S. Quimby, of The Texas Company's Technical and Research Division, New York, pointed out that interior corrosion on tankers alone costs as much much as $50,000 a year per tanker. He covered all phases of rust and corrosion control in transportation, pointed out that many new processes for control have been announced, and more are in the development stage.

R. B. Hoxeng, head of the chemical and metallurgy division of the Research and Development Laboratory, U. S. Steel Corporation, Pittsburgh, described the testing of rust preventive compounds for use in the steel industry.

E. J. Schwoegler, of Armour Research Foundation of Illinois Institute of Technology, Chicago, discussed some of the factors in evaluating corrosion and corrosion inhibitors. He urged the industry to encourage its sales and technical service people to relay reports from the field on the effectiveness of inhibitors.

H. A. Ambrose and E. S. Francis, of Gulf Research and Development Company, Pittsburgh, and E. E. Fisher, of Gulf Oil Corporation, Refinery Technology Laboratory, Philadelphia, pleaded for more understanding in the use of laboratory tests to evaluate rust preventives, particularly where purchase specifications are involved.

A. W. Scott, president of Wolf's Head Oil Refining Company, Oil City, Pa., was re-elected NPA president. Other officers re-elected were:

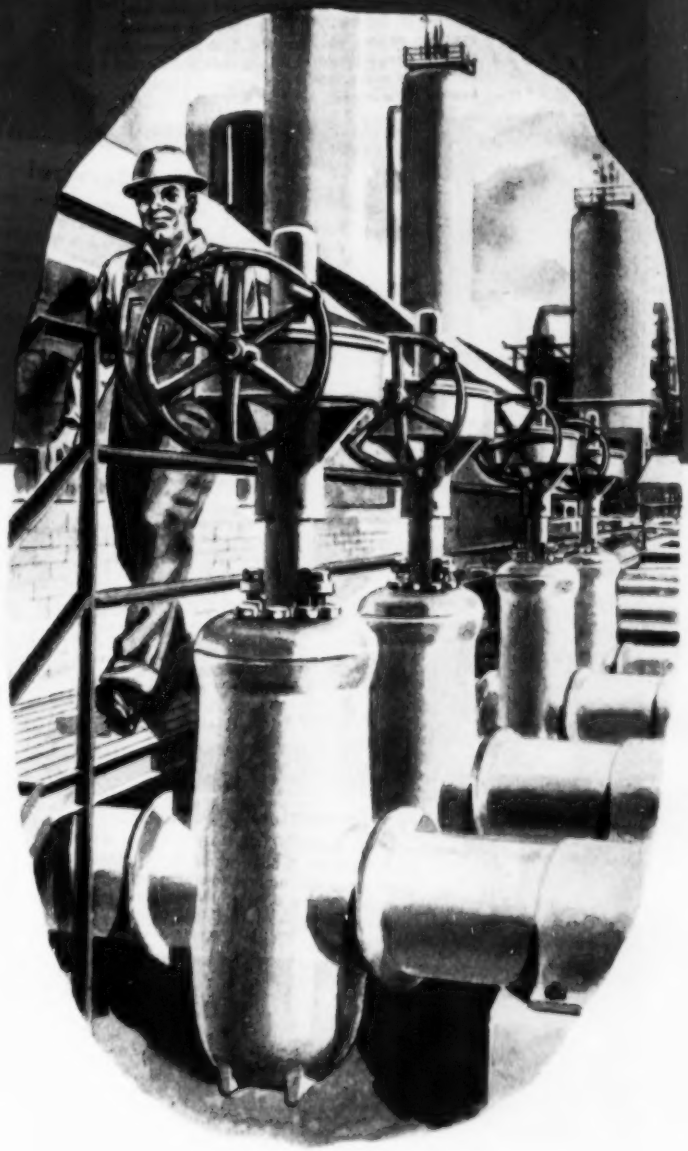
Fred G. Bannerot, Jr., of Elk Refining Company, Charleston, W. Va., first vice president; Paul R. Beck, of Pennsylvania Refining Company, Butler, Pa., second vice president; Fayette B. Dow,

NOTE—Program of API 1953 Session, Page 209

"FOUR YEARS' FLUE-GAS SERVICE AT 800° F. AND STILL IN EXCELLENT CONDITION..."

W-K-M PROCESS VALVES

(PATENTED)



Four years ago a large southwestern oil refinery installed four 12" W-K-M Process Valves in the flue-gas lines of a hydroformer unit. The flue-gas, containing sulphur, passed through the valves at 800° F. at a pressure of 300 p.s.i. A recent check showed that the valves were still in good shape and the seating surfaces were in good condition.

These valves were standard steel trim except for the seating surfaces which were inlaid with Hastelloy alloy B, which trim is also used for such severe services as hydrochloric acid solutions, sulphuric acid solutions, isopropyl alcohol, hot rich oil and propane and butane.

W-K-M Process Valves have all the features of the Standard W-K-M Valves, such as exclusive leverlock operation, parallel expanding gate assembly, through conduit flow and renewable seats plus other design features especially developed to meet the needs of process service.

Write for W-K-M Bulletin 698 for complete information about W-K-M Process Valves.

W-K-M Valves

W-K-M Company, P. O. Box 2117, Houston 1, Texas

2330 E. 8th St., Los Angeles, Calif.

Export Office: 30 Rockefeller Plaza, New York, N. Y.

THIS GEM OF A FLOOR PLATE OFFERS FIVE POINTS

Flawless Foot Safety!
Although all floor plates have raised figures, only one—A.W. SUPER-DIAMOND—has the anti-skid precision pattern you see here. Each diamond is placed perpendicularly to its neighbor. This means that every footstep is across the grain—every step is secure.
Jeweled Surface Service!
More than forty diamond traction points grip every footstep. Regardless of the angle of approach or the incline of the flooring, A.W. SUPER-DIAMOND holds footsteps fast, offering maximum skid-resistance. Every diamond works against a skid.
Quality With Savings!
The initial cost of A.W. SUPER-DIAMOND is low—and so is the maintenance. Perfect matching end-to-end and side-by-side in SUPER-DIAMOND permits cutting with a minimum of waste. Cleaning is the only maintenance.
Tough As A Diamond!
A.W. SUPER-DIAMOND is a steel floor plating that possesses diamond-like hardness and toughness. Years of abuse and hard use won't wear out this rolled floor plate. It withstands hard blows and heavy loads without cracking or breaking—and it's resistant to oil, heat, and fire.
No Special Cleaning!
Although SUPER-DIAMOND'S exclusive pattern holds footsteps, it doesn't hold dirt. No cracks or joints mean this plating can be cleaned easily with broom, mop, or hose—and it dries fast after washing. If you want, SUPER-DIAMOND can be painted.
For safety with economy in potential accident spots in your factory, get complete information about A.W. SUPER-DIAMOND Rolled Steel Floor Plate. Simply clip and mail this coupon, and we'll be glad to send you technical data and suggestion for use.
A.W. SUPER-DIAMOND
ROLLED STEEL FLOOR PLATE
ALAN WOOD STEEL COMPANY
CONSHOHOCKEN, PENNA.
Please send me Booklet SD-57 on A. W. SUPER-DIAMOND
Name
Title
Company
Address
City Zone State
Other products: A. W. ALGRIP Abrasive Rolled Steel Floor Plate • Plates • Sheets • Strip (Alloy and Special Grades).

Who's **Meeting . . .**

of Washington, D. C., general counsel; G. B. Hunter, of Quaker State Oil Refining Corporation, Oil City, Pa., treasurer; and Margaret A. Miller, of Washington, D. C., assistant treasurer.

AIChE

A series of three technical papers dealing with the economics of chemical engineering processes were featured at the National Meeting of the American Institute of Chemical Engineers in San Francisco, September 13 to 16. These papers were: "Economic Evaluation of Several Processes for the Production of Ammonia Synthesis Gas From Natural Gas," by B. J. Mayland, E. A. Comley and J. C. Reynolds of the Girdler Corporation; "Plant Costs for Acetylene From Hydrocarbons in Comparison of Regenerative and Partial Combustion Processes," by M. J. P. Bogart and R. H. Dodd of the Lummus Company; and "Consideration of Capital Costs for a Petrochemical Project" by E. B. Chiswell and J. J. Merrill of California Research Corporation.

Ammonia

Ammonia is manufactured from nitrogen and hydrogen at high pressures of about 400 times that of the atmosphere. The mixture of nitrogen and hydrogen used for the manufacture of ammonia is known as ammonia synthesis gas. Recently important economics have been made in processes for the manufacture of this gas. In the past most synthesis gas was made from coal, air, and steam. During the last few years increasing quantities of synthesis gas have been made from natural gas, air, and steam. Improvements in the manufacture from natural gas are continuing. The resulting lower costs of ammonia have been an important factor in the greatly expanded use of ammonia for fertilizer purposes. In fact, ammonia prices have declined during a period when other costs were sharply rising.

Acetylene

Until recently the only method used for commercially manufacturing acetylene was the well known reaction between calcium carbide and water, which was used in the old carbide auto lamps. The calcium carbide is produced in the electric furnace from lime and carbon. However, development of other methods of making acetylene, using natural gas as the raw material, has reached the point where they are economically practical.

Natural gas is in some ways chemically similar to acetylene, and when it is heated to high temperatures, it is in part converted to acetylene. Variations in the way the high temperatures are attained and variations in the method for separating the acetylene from other products formed make possible a number of different processes of this type. In their study Bogart and Dodd considered the differences in investment costs resulting from such variations in two different processes.

The two processes, the regenerative and the partial combustion, differ considerably in the method by which they heat the natural gas to the temperature necessary to "crack" it to acetylene. In the regenerative process some gas is

Meet the man you can call with confidence to solve your thermal insulation problems

To insulate outdoor tanks with complete weather protection, these skilled J-M applicators follow a specification developed by Johns-Manville. Here they are fastening J-M Asbestocite* Sheets over J-M Zerolite* Insulation. J-M 85% Magnesia Insulation is also widely used for this type of equipment

He is your J-M Insulation Contractor... the man with the world's most complete insulation engineering service

"Insulation is no better than the man who applies it." Today, with rising fuel and maintenance costs, it is especially important to place your insulation job in skilled hands. The scientific application of J-M quality insulations by J-M Insulation Contractors will assure you of the maximum return on your insulation investment for years to come. Moreover, you get undivided responsibility for *all* your insulation requirements.

1. You get dependable materials—Johns-Manville manufactures a complete line of insulations for every service temperature from minus 400F to plus 3000F. From them your J-M Insulation Contractor can select the right insulation for the most dependable service on your job. To develop new and improved insulation materials Johns-Manville maintains the J-M Research Center—largest laboratory of its kind in the world.

2. You get dependable engineering—For 95 years Johns-Manville has been accumulating insulation engineering experience. J-M Insulation Engineers are called upon to solve insulation problems of every type and magnitude, in every industry. Since your J-M Insulation Contractor works closely with J-M Insulation Engineers, he brings to *every* job a high degree of training, skill and experience.

3. You get dependable application—Johns-Manville has set up a nationwide organization of J-M Insulation Contractors to serve you. These Contractors maintain staffs of insulation engineers as well as skilled mechanics thoroughly trained in J-M's proved application methods. You can have absolute confidence in their ability to apply J-M insulations correctly for trouble-free performance.

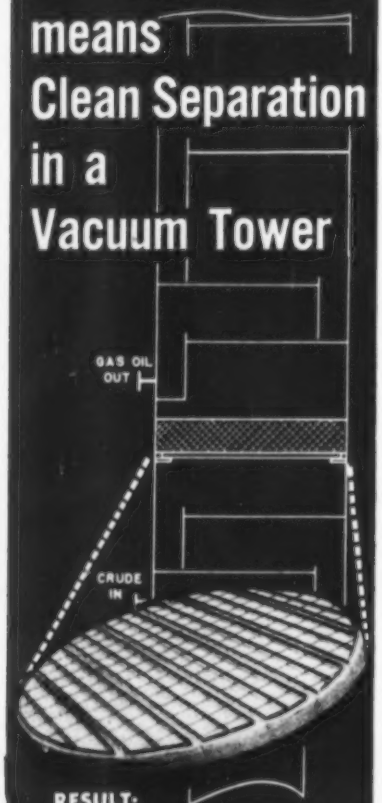
For further information and the name of your J-M Insulation Contractor, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

*Reg. U. S. Pat. Off.

Johns-Manville *FIRST IN* INSULATION

MATERIALS · ENGINEERING · APPLICATION

This YORKMESH DEMISTER means Clean Separation in a Vacuum Tower



RESULT:
Cleaner gas oil with reduction in carbon and metals contamination which means increased yield of higher octane gasoline from your cat cracker.

For installation in—
LUBE VACUUM TOWERS
DISTILLATION EQUIPMENT
GAS ABSORBERS
SCRUBBERS
SEPARATORS
EVAPORATORS
KNOCK-OUT DRUMS
etc.

Send today for Catalog 13

OTTO H. YORK CO., INC.
63 Glenwood Place, E. Orange, N. J.

Who's **Meeting . . .**

burned and used to heat up a bed of ceramic material, and this bed is then used to heat up a separate mass of gas to the cracking temperature. In the partial combustion process some of the natural gas is allowed to partially burn in air and so to raise the temperature of the unburned portion to the desired level. This basic difference in the two processes will also affect the design of other sections of the plant. To fully evaluate the relative economic position of the processes requires a careful analysis of the investments required. It is such a study, fundamental to chemical plant design, that Bogart and Dodd have made.

WPRA

The Western Petroleum Refiners Association will sponsor a Regional Technical-Industrial Relations meeting in the Garrett Hotel, El Dorado, Ark., October 22-23.

Thursday, October 22, has been set aside for a day-long question and answer session on refinery technology and problems associated with refining operations. A panel representing the operating and engineering segments of the refining industry will discuss topics of current importance—with audience participation. Typical of the questions which have already been submitted for panel consideration are: "At what gasoline mercaptan level should you contemplate mercaptan extraction facilities to reduce TEL requirements?"; "What are the methods, if any, in recovering gases which are normally flared?"; "Is anyone thermally cracking cat-cycle oils? If so, what are the operating conditions and yields?"; and many others. Questions may be sent to Paul D. Williams, WPRA Technologist, 1414 Hunt Building, Tulsa 3, or questions may be brought to the meeting.

A list of those who will serve on the panel includes: W. M. Carney, superintendent, Lion Oil Company, El Dorado; A. D. Fischbeck, manager, Perco division, Phillips Petroleum Company, Bartlesville; H. K. Wheeler, assistant manager—technical, Pan-Am Southern Corporation, El Dorado; D. B. Ardern, superintendent, Technical Service dept., Houdry Process Corporation, Philadelphia; E. C. Tinsley, manager, Specialty division, Mexico Refractories Company, Mexico, Mo. Companies that have not yet announced their panel representatives are Universal Oil Products Company, Berry Asphalt Company, American Cyanamid Company and Deep Rock Oil Corporation.

A cocktail party, courtesy the Refinery Supply and Service group, will precede the traditional WPRA informal dinner Thursday evening.

The industrial relations phase of the meeting will be held on Friday, October 23, with J. L. Ward, president, Personnel Managers Association of Arkansas, presiding. Members of PMAA have been invited to attend and participate. Industrial relations topics to be heard and the speakers are: "What Service Can Various Public Educational Institutions Offer to an Industrial Relations Program?" J. C. Ruppert, state superintendent, Trade and Industrial Education, Little Rock; "Alcoholism in Industry," D. F. Tver, director of industrial relations, Anderson-Prichard Oil Corporation, Oklahoma City; "How the Dale Carnegie Course Can Assist Your Employer-Employe Relations Program," Curtis Kinard, oil operator, El Dorado; and a talk concerning the problem of employe communications by V. Murray Clerkin, superintendent, Industrial Relations division, Standard Oil Company (Indiana), Neodesha, Kan.

Lion Oil Company and Pan-Am Southern Corporation will be co-hosts at a cocktail party following the Friday program. The monthly dinner meeting of the Personnel Managers Association of Arkansas which will conclude the day's activities is open to WPRA members and guests. W. E. Bennett, supervisor of training, Cities Service Refining Corporation, Lake Charles, will speak on "Why Have a Training Program?"

Non-members of the WPRA may attend the Association-sponsored meeting, officials pointed out. There is no registration fee.

IN THE FUTURE

OCT.	
11-17	**Oil Progress Week.**
19-23	**National Safety Council (Annual Congress), Conrad Hilton, Congress, Morrison, Sheraton, Chicago.**
22-23	**Western Petroleum Refiners Association (Regional Meeting), Garrett Hotel, Eldorado, Ark.**
23	**Natural Gasoline Association of America (Regional Meeting), Blackstone Hotel, Tyler, Texas.**
26-28	**National Lubricating Grease Institute, (Annual Meeting), Edgewater Beach Hotel, Chicago.**
NOV.	
2- 4	**American Oil Chemists' Society (27th Fall Meeting), Sherman Hotel, Chicago.**
2- 6	**American Institute of Electrical Engineers (Fall General Meeting), Muehlebach Hotel, Kansas City, Mo.**
9-12	**American Petroleum Institute (33rd Annual Meeting), Conrad Hilton Hotel and Palmer House, Chicago.**
19-20	**Third Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif.**
21	**Natural Gasoline Association of America (Regional Meeting), Herring Hotel, Amarillo, Texas.**
29 to Dec. 4	**American Society of Mechanical Engineers (Annual Meeting), Statler Hotel, New York.**
DEC.	
13-16	**American Institute of Chemical Engineers (Annual Meeting), Jefferson Hotel, St. Louis.**
20	**Natural Gasoline Association of America (Panhandle-Plains Regional Meeting), Herring Hotel, Amarillo, Texas.**
JAN.	
1954	
18-22	**American Institute of Electrical Engineers (Winter General Meeting), Statler Hotel, New York.**
FEB.	
15-17	**American Petroleum Institute (Lubrication Committee), Sheraton-Cadillac Hotel, Detroit.**
26	**Natural Gasoline Association of America (Permian Basin Regional Meeting), Lincoln Hotel, Odessa, Texas.**
MAR.	
1- 5	**American Society for Testing Materials (Spring Meeting), Shoreham Hotel, Washington, D.C.**
8-10	**American Institute of Chemical Engineers, Statler Hotel, Washington, D.C.**
15-19	**National Association of Corrosion Engineers (Tenth Annual Conference), Municipal Auditorium, Kansas City, Mo.**
APRIL	
21-23	**Natural Gasoline Association of America (33rd Annual Convention), Baker Hotel, Dallas, Texas.**

New **BOOKS . . .**

Hot and Cold Bending

Pipe and Tube Bending. Paul B. Schubert, The Industrial Press, 148 Lafayette Street, New York 13. $5.

This practical working manual describes and illustrates common methods of bending ferrous and non-ferrous pipe and tubing; the machines, fixtures and devices used, and gives data and pointers that are useful in both shop and the field. It has been written for shop and field men, designers and engineers who are concerned with the bending of pipe and tubing for all types of indoor and outdoor applications such as: tubular fabrication, food and chemical process piping, and both private and commercial radiant heating installations. The descriptive information and data are arranged so that the reader can compare the various methods and become familiar with their respective advantages and limitations.

An entire chapter devoted to the layout of pipe for bends gives the formulas employed for various degrees of bend, and also includes information and data concerning minimum radii of bends. Information on topics such as filler materials, mandrels, wooden dies and tube-coiling and bending operations in the field, heretofore not readily available in book form, is given.

Subjects covered in the book include: Methods of Bending; Length and Minimum Radii of Bends; The Use of Fillers and Mandrels in Bending; Compression Bending; Draw Bending; Ram and Press Bending, Roll Bending, Wrinkle Bending, and Hot Bending of Large Sized Pipe and Tubing.

Waste Water Analysis

Manual on Disposal of Refinery Wastes, Volume IV, Sampling and Analysis of Waste Water, Division of Refining, American Petroleum Institute, 50 West 50th Street, New York 20. $5. (Direct all orders to J. A. McNally.)

This first edition of Volume IV discusses latest procedures for dealing with effluent waters from refinery operations and should be of great value to analytical laboratory supervisors and others engaged in pollution control work. It brings up to date material contained in Volume I, entitled *Waste Water Containing Oil*, which is now in its fifth edition. Available in loose leaf form for easy revision as new procedures are developed, it supplements previous volumes to bring the Manual one step near completion.

Methods discussed in detail in Volume IV include: Collection and preservation of Samples; Spot Samplers and Their Use; Automatic Compositing Samplers; Absolute Density of Waste Water; Absolute Viscosity of Waste Water; Acidity and Alkalinity; pH; Solids; Total and Dissolved Sulfides; Dissolved Hydrogen Sulfide, and many others.

Scientific Dictionary

Stewart's Scientific Dictionary. Jeffrey R. Stewart, Gardner Laboratory, Inc., Bethesda 14, Md. $10.50 (U. S. and Canada).

This fourth edition of Stewart's dictionary contains all of the more widely

CATAWISSA
DOUBLE UNION SWING CHECK VALVE
"502"

FULL OPENING FOR 100% UNOBSTRUCTED FLOW!

COMPACT!
EFFICIENT!
ECONOMICAL!
EASILY ACCESSIBLE!

flow line and pipe line type for general oil country use in either horizontal or vertical position!

CATAWISSA Double Union Swing Check Valves are designed and recommended for the rough and ready demands of oil country applications in lines where no stop is installed close to the check valve and where pipe cleaning mechanisms (go-devils) are used. They are FULL OPENING, furnished with Catawissa PERFECT SEAL Unions on both ends to permit breaking the line at inlet end, with check holding line contents. Union connection on both ends eliminates the use of a full union and nipple necessary to install regular type check valves.

REFAX METAL BODIES
HITENSILOY WORKING PARTS
★
500-lbs. SERVICE O.W.G.
1500-lbs. TEST
250-psi WSP
★
SIZES 2" to 4"

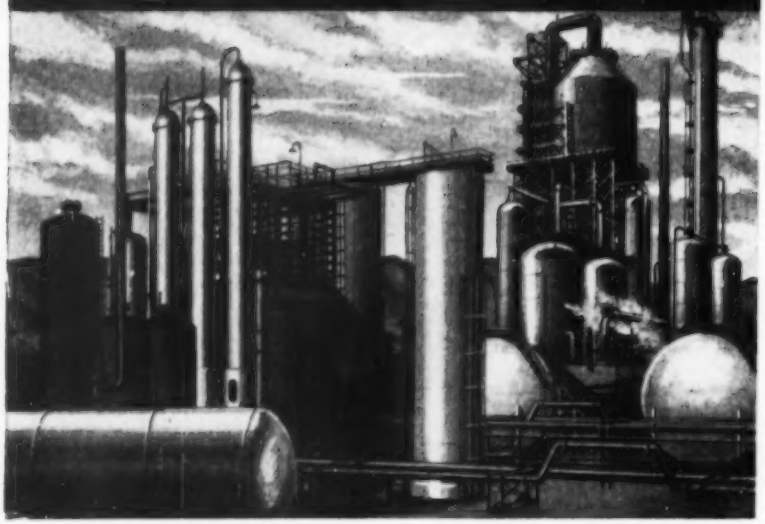
SEE OUR CATALOG IN THE COMPOSITE CATALOG

AVAILABLE THROUGHOUT THE OIL FIELDS AT LEADING SUPPLY STORES

WRITE FOR A FREE COPY OF NEW CATALOG 11

CATAWISSA VALVE & FITTINGS COMPANY
60 MILL STREET ★ CATAWISSA, PENNA.

Why REFINERIES-



Are using "DBPC" inhibitor in motor gasoline storage

IF you are interested in getting the best and most economical protection against oxidation of motor gasoline in storage, "DBPC" inhibitor (di-tertiary-Butyl-para-Cresol) is worth your serious consideration.

Several large American refineries are now using this Koppers oxidation inhibitor under actual gasoline storage conditions, and have found that:

- **"DBPC" is more economical on a pound per barrel basis than any other gasoline antioxidant.**
- "DBPC" prevents the formation of gum in motor gasoline over storage periods of six months.
- It can be added early in the refining process when the gasoline is most susceptible to inhibitor addition.
- Once added, "DBPC" cannot be extracted from the gasoline by water, caustic, clay, or the commonly-used pipe line corrosion inhibitors.
- "DBPC" antioxidant will not impart color to motor gasoline.
- "DBPC" is safe to handle. It is non-irritating and practically non-toxic under normal handling conditions.

For more details about "DBPC"—either in flake or solution form, write to Koppers today.

KOPPERS COMPANY, INC.
Chemical Division, Dept. PR-103, Pittsburgh, 19, Pennsylvania

KOPPERS ® **Koppers Chemicals**

New **Books** . . .

used terms in the chemical processing industries, including plastics, paints, soaps, detergents, insecticides, industrial chemicals, packaging materials, and petroleum. With almost 1000 pages, the book represents a collection of pertinent information gathered from many sources and includes many new industrial terms which are not to be found in other dictionaries.

Petroleum Technology

Reviews of Petroleum Technology in 1951, The Institute of Petroleum, 26, Portland Place, London, W. 1. 50 s. (post free).

This thirteenth volume in the series of annual reviews on the progress of petroleum technology covers developments during 1951 and follows in general the lines of its predecessors. Nearly 3000 references to articles which appeared in the technical press during the period under review are included in the book's 21 chapters. Three chapters of the book cover 1950-51 (plant instrumentation, insulating and hydraulic oils, bitumen); one (petroleum waxes) 1949-51; and another (transport, storage and distribution) 1947-51.

In the Preface, Honorary Editor Professor F. H. Garner makes special reference to the fact that the period under review sometimes covers more than one year, and indicates that the future of "Reviews of Petroleum Technology" has been subject of consideration by the Council of the Institute. Since the preface was written, a decision has been made to publish the reviews on a somewhat different and broader basis to cover a three-year period. It is planned to issue the next volume early in 1955 to cover the triennial period 1952-1954.

Distillation Survey

Distillation Literature Index and Abstracts, 1946-1952, Arthur and Elizabeth Rose, Applied Science Laboratories, Inc., 140 North Barnard Street, State College, Pa. $25.

Now available in one volume is this complete literature survey of distillation during the period 1946-52. The authors have carefully indexed and abstracted all articles which have been published during this period on the subject of distillation. The book includes abstracts of and references to articles in scientific and technical journals, and to patents, books, news items and advertising announcements of importance. Divided into three sections, this sequel to the 1941-45 Edition includes a condensed list of subject index headings, a main subject index and a final author index. This book answers to the need of coordinating published information, which has become just as important as the discovery of new material.

Management Problems

1953 Industrial Management Symposium, The Consolidated Reporting Company, 303 Fourth Avenue, New York 10.

Here is a readable coverage of most general problems met by management. Twenty-seven phases of good management are discussed by authors engaged in industries with varied technical but kindred management problems. Topics

New **Books** . . .

include incentive, indoctrination, statistical work measurement, grievances, cost-cutting through personnel training, employer-employe supervision, and engineering in management.

Communication of Accounting

Objective Accounting, A Problem of Communication, Carl F. Braun, C. F. Braun & Company, Alhambra, Calif. $1.75

This book on industrial accounting is addressed primarily to industrialists and engineering leaders. Its purpose is to enlist the help of engineers and others in bridging the gap that exists between accountants and the industrial enterprises that are dependent upon them for guides and checks.

On the theme that accounting is a mixture of both fact and opinion and is not properly recognized as a forceful means of communication, the book, written in understandable style, covers aspects of accounting missing in the extensive literature on the subject.

Toxological Reviews

Availability of another series of toxological reviews of substances used or produced in the oil industry has been announced by the American Petroleum Institute. The reviews are designed as reference materials for oil companies engaged in chemical activities.

The latest series contains toxological reviews on 31 substances, ranging from acetic acid to triethanolamine. This series is a supplement to the two series issued in 1948, setting the number of substances on which API has toxological reviews available at 63. These are listed on a leaflet which may be obtained upon request.

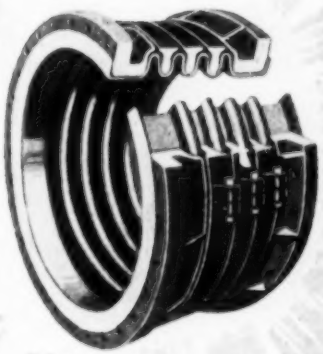
Price of each review is 25 cents, but the three series may be obtained from API as follows: April, 1948, 14 substances, $3; September, 1948, 18 substances, $3.50; June, 1953, 31 substances, $6.50; all three sets, $13.

Chemicals Wanted

The National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Federal and Dearborn Streets, Chicago 16, has received urgent requests for the chemicals listed below. If anyone has one or more, even if only one gram quantities, please inform the Registry.

Cesium sulfide
Barium aluminate
Di-tert.-butyl magnesium
Phenyl tellurium tribromide
Allylbenzene
Dioctyl ketone
Perfluorodecanoic acid
Camphenilane
Butadiene monoxide
1,2-Diaminocycloheptane
Butylmethanesulfonic acid
3,4-Di-sec.-butylcatechol
2,6-Dichlorobenzaldehyde
Duroquinone
3-nitrocarbazole
Pentachlorobenzene
1,2,3,4-Tetrahydrochlorobenzene
L-Limonene
2,4,4-Trimethyl-3-pentanone
Vinylsulfonic acid

Designed for **DURABILITY** as well as Flexibility



DURABILITY is designed into the Badger Directed-Flexing, Self-Equalizing Joints:

1 each corrugation is designed with the proper depth for its diameter; each diameter is gauged to its proper traverse

2 each corrugation—and it's the Badger ***all curve*** corrugation—is shaped to flex by Directed Flexing using matching shaped equalizing rings to guide and control the flexing movement. The corrugation wraps and unwraps itself, using the rings as the bearing surface, distributing the flexing stresses evenly over all areas of each of the all-curve corrugations.

3 each corrugation is progressively controlled and limited to its proper flexing traverse

4 the corrugations are formed from a single metal tube of suitable length by a special forming process which minimizes forming stresses in the metal

5 every joint is scientifically heat-treated at each of several key steps in its manufacture

The many thousands of Badger Directed-Flexing, Self-Equalizing Expansion Joints in service now for many years are in themselves testimonials as to their durability. They will serve you equally well. With a wide range of sizes in either flanged or welding end design, with a choice of several metals, with facilities for designing special joints, why not let our expansion joint specialists take care of your requirements?

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

WHO'S Building . . .

GREECE Seeks Refinery Bids

Continued from page 96

ernment. That government has set down general directives and limits of its program on which proposals should be based. These are:

Productive capacity: installation should insure processing of 30,000 barrels a day of crude oil.

Distillation method: planned method is that of topping and reforming. However, applicants may also submit proposals for installation of thermal cracking.

Crude oil products: refinery should principally cover requirements of Greek market in all liquid fuels. Following approximate percentages are mentioned indicatively: motor gasoline 21 percent, kerosine 7 percent, diesel oil 23 percent, fuel oil 49 percent.

Origin of crude oil: Greek government considers Middle East crude oil as most suitable. This does not mean the government will not be willing to discuss, with an equal interest, proposals for utilizing crude oil of different origin.

The Greek government is willing to contribute a loan up to 50 percent of the total cost of the refinery's construction if this is requested by the applicant. Proposals should be submitted by November 15, 1953, to the Ministry of Coordination in Athens.

Within four days of its initial request for proposals, the Greek Ministry of Coordination is reported to have received some 30 bids.

UNION OIL Assigns Work For First Project at Oleum

Contracts totaling $5,750,000 have been assigned by Union Oil Company of California for construction of the initial unit in the $40 million program at its Oleum, Calif., refinery. Union's construction program at Oleum is designed "to obtain more and higher octane gasolines" from its crude oils.

The company's contract with C. F. Braun & Company calls for completion of a Platformer by November, 1954. This is the catalytic reforming unit licensed by Universal Oil Products Company. Construction of this unit is not expected to start before early next year. The Platformer will have a daily feed capacity of 14,500 barrels of gasoline stocks.

Bechtel has the contract for construction of outside facilities, utilities and tankage required for the Platformer operation.

Union's $40 million program calls also for construction of a catalytic desulfurization unit, a coker, a sulfur removal unit and processing unit, a gasoline finishing unit and auxiliary facilities.

SUNRAY OIL Producing Alkylates at Duncan Refinery

Production of 1500 barrels a day of high octane aviation alkylates has been started by Sunray Oil Corporation at its Sunray Village refinery at Duncan, Okla.

The start-up of Sunray's new $1.7 million HF alkylation plant was almost simultaneous with the request of Petroleum Administration for Defense that the nation's oil refiners increase production of this vital fuel.

SCHOLVEN-CHEMIE Starts Up New Cat Cracker in Germany

A new catalytic cracking unit has been completed and placed on stream at the Scholven-Chemie, A.G., plant at Gelsenkirchen-Buer in West Germany. The unit is of the Kellogg Orthflow design.

The plant now has capacity enough to process the full 400,000 tons annually (about 8000 barrels a day) provided for in the plan of the Organization for European Economic Cooperation.

The new unit represents the first phase of expansion and modernization of the Scholven plant. It was built by the German firm of Friedrich Uhde, G.m.b.H.

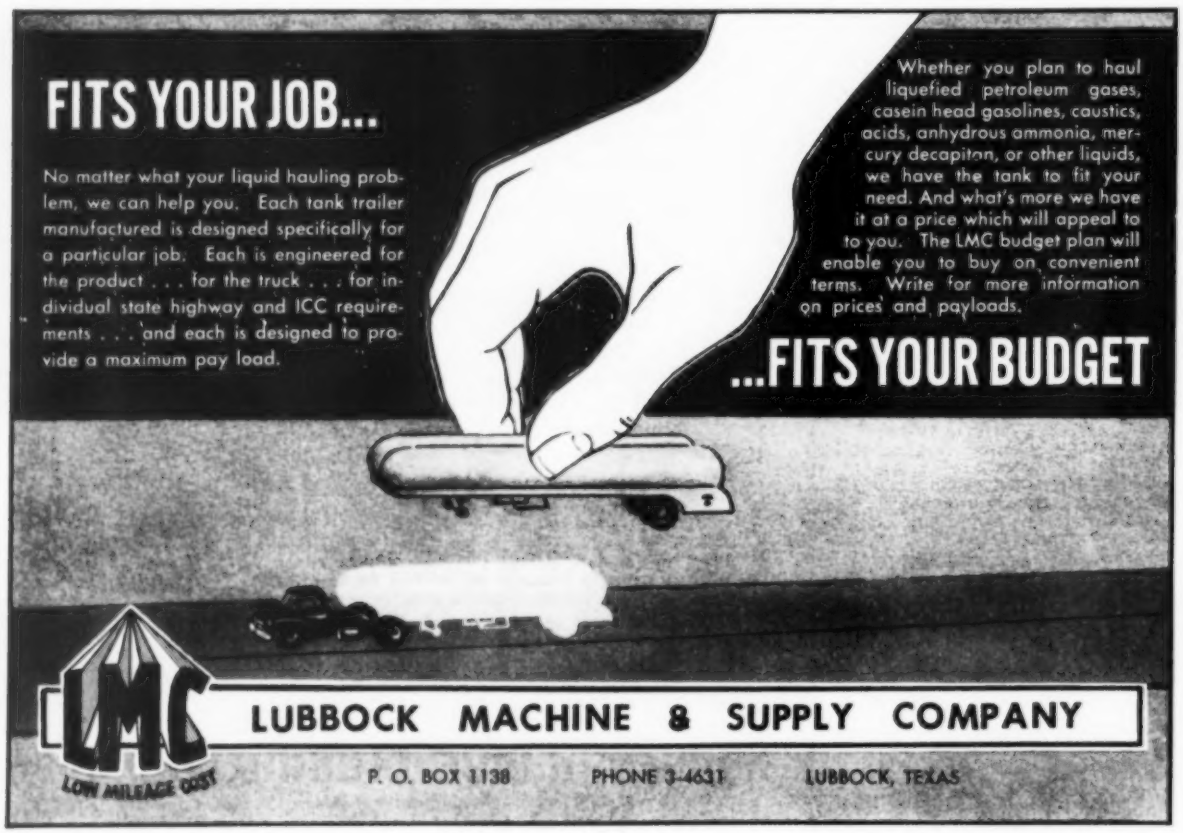
HANCOCK Announces Plans For 4200-Barrel Cat Cracker

Hancock Oil Company of California has announced its projected Thermofor catalytic cracking unit will have a 4200-barrel-a-day charge capacity, and that it will build also a 350-barrel-a-day polymerization plant. Earlier that company had made known plans to spend $4 million on refinery improvements, including a TCC unit.

About a year will be allowed for construction after the company awards contracts. Earliest likely date of completion will therefore be late 1954 or early 1955. Hancock will invite bids in the near future.

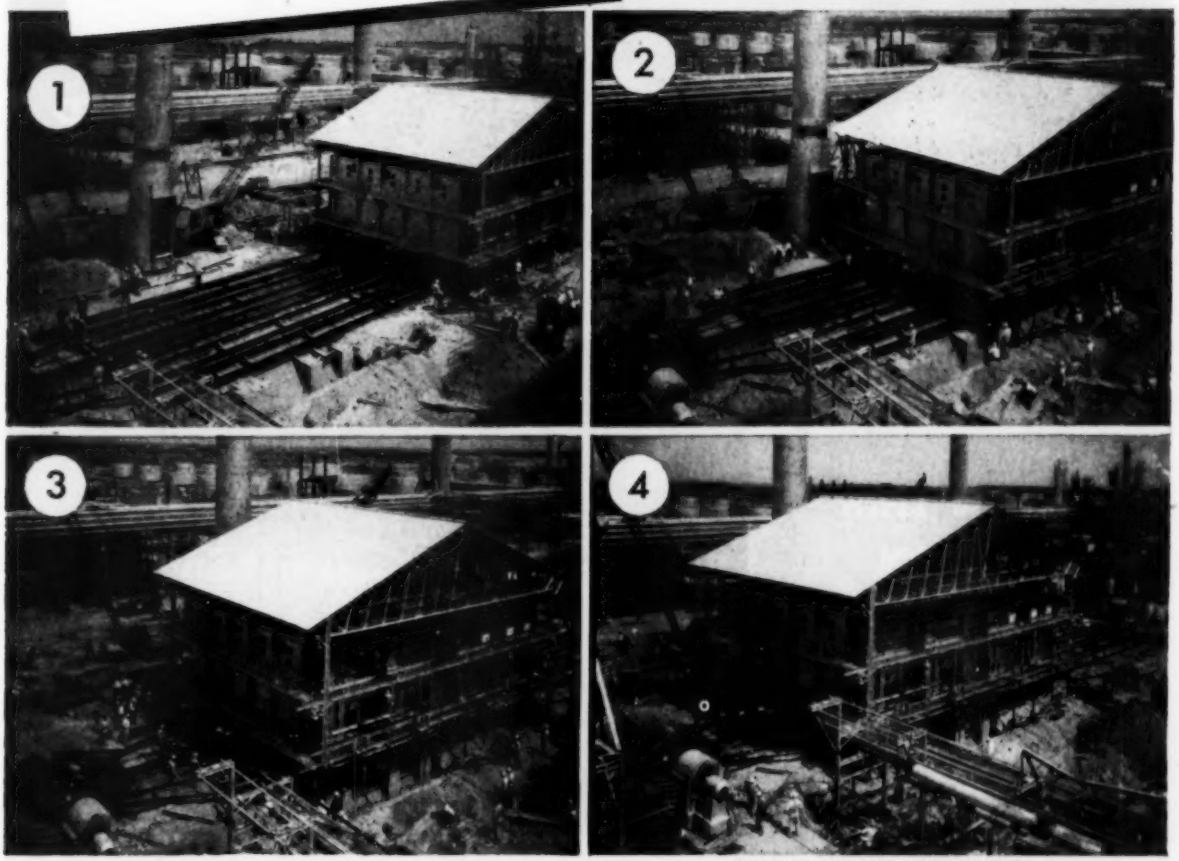
PAN AMERICAN Decides on Location of Proposed Refinery

Pan American Refining Corporation's proposed new East Coast refinery will be located in Goodwin Neck, York County, Va. Present plans of the com-


FITS YOUR JOB...
No matter what your liquid hauling problem, we can help you. Each tank trailer manufactured is designed specifically for a particular job. Each is engineered for the product . . . for the truck . . . for individual state highway and ICC requirements . . . and each is designed to provide a maximum pay load.
Whether you plan to haul liquefied petroleum gases, casein head gasolines, caustics, acids, anhydrous ammonia, mercury decapitan, or other liquids, we have the tank to fit your need. And what's more we have it at a price which will appeal to to you. The LMC budget plan will enable you to buy on convenient terms. Write for more information on prices and payloads.
...FITS YOUR BUDGET
LMC
LOW MILEAGE COST
LUBBOCK MACHINE & SUPPLY COMPANY
P. O. BOX 1138
PHONE 3-4631
LUBBOCK, TEXAS

40% LIGHTER
...easier to move

This short haul moving job cuts furnace down-time from 5 months to 6 weeks. With the Lummus portable heater method, the new oil heater is built on skids near the old one. When construction is completed, the old heater is shut down and dismantled (Picture 1). Then the new one is quickly moved in place on the original heater site (Pictures 2, 3 and 4).



PHOTOS COURTESY THE LUMMUS COMPANY

Moving a 900 ton oil heater is no cinch, but it's a lot easier than budging one that weighs 1500 tons. This 600 ton difference stems from the use of *lightweight* B&W Insulating Firebrick in place of ordinary heavy firebrick in this portable oil heater.

Simplifying the moving job is only one of the advantages of B&W Insulating Firebrick . . . one *more* reason why The Lummus Company specified this lightweight brick for many portable heater installations.

Of even greater importance is the fact that B&W IFB store and conduct less heat. Thus they cool off fast, reduce down-time, make possible quick access to the furnace for inspection. Installation costs are cut, too, because these lightweight brick can be cut, drilled or shaped with ordinary woodworking tools. What's more, these lightweight brick may be supported or anchored with ordinary carbon steel. There's no need to use expensive, heat-resisting alloys.

BABCOCK & WILCOX

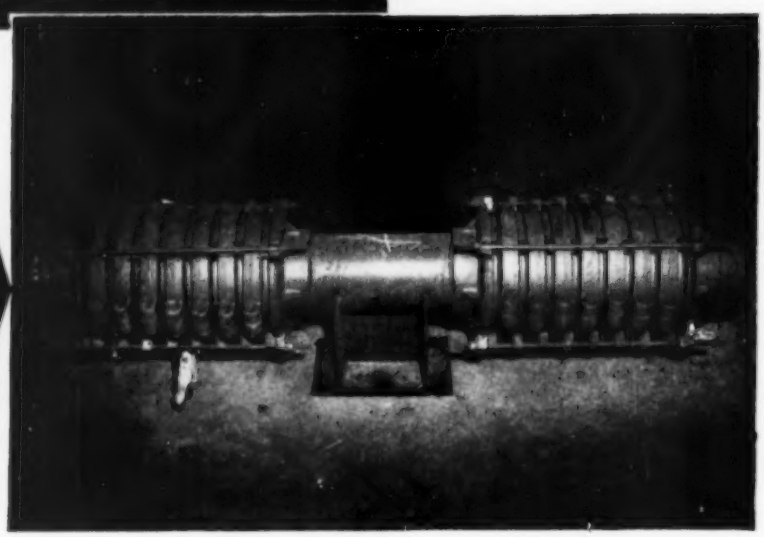
THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 161 EAST 42nd ST., NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

R 483

B&W REFRACTORIES PRODUCTS — B&W Alfrax Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

THIS STEAM LOSS WAS STOPPED FOR LIFE...

WHEN THIS FLEXON EXPANSION JOINT WAS INSTALLED



THREE TYPES AVAILABLE

FREE-FLEXING—*Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 30 psi, temperatures from minus 20° F. to 800° F.*

CONTROLLED-FLEXING — (Illustrated above) *Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 300 psi, temperatures from minus 20° F. to 800° F.*

FLEXONIFLEX—*Integral ring type. Available in sizes from ½" pipe through 6" pipe. Suitable for pressures to 5500 psi, temperatures from minus 400° F. to 1600° F.*

Steam loss through antiquated expansion joints in the shipyard where the upper photo was taken was calculated at over $17,500 per year before modern Flexon Expansion Joints were installed. Flexon Expansion Joints cannot leak . . . they are uni-metal assemblies which when properly installed become a part of the pipe. Unlike the joints which they replaced in this shipyard, Flexon Expansion Joints require no maintenance . . . there is no packing to take up or replace. Just install them and forget them.

If you're letting dollars escape through leaky, troublesome expansion joints, ask your Flexonics representative to show you how Flexon Expansion Joints can put an end to this problem, or write for the Flexon Expansion Joint Bulletin.

Flexonics Corporation

EXPANSION JOINT DIVISION
1336 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Flexible metal hose

Expansion joints

Aircraft components

Metallic bellows

pany call for commencement of construction within five months, with completion of the refinery scheduled for late 1955. Initial refining capacity will be 25,000 barrels a day.

SHELL Awards Contract for Work at Anacortes Refinery

Bechtel Corporation has been awarded the general contract for construction of Shell Oil Company's 50,000-barrel-a-day refinery at Anacortes, Wash. Over-all planning and preliminary engineering have been under way for some time; actual field construction of the refinery units will start about the middle of 1954 because six to nine months are needed for further engineering and purchasing equipment. Much of the equipment and material, except specialized units unavailable in the area, will be purchased in the Northwest.

Major refining units to be installed include a crude oil fractionating unit, a platformer and a catalytic cracker. The crude unit and the platformer will be finished by the middle of 1955, and the remaining units, including the cat cracker, by the end of 1955.

The first units will be put into operation before the entire refinery is completed, permitting the plant to produce its first manufactured products earlier. It is expected that the first products will begin to come off the line about mid-1955.

PURE OIL Will Install New-Type Catalytic Reformer

Contract for the design and erection of a catalytic reformer at The Pure Oil Company's Heath, Ohio, refinery has been awarded The M. W. Kellogg Company. The plant will use the new Sinclair-Baker platinum catalyst for which Kellogg is sales agent.

The new plant at Heath will process 3000 barrels of naphtha daily and will convert low octane feed to high octane gasoline. Provision will be made in the design of the plant for its operation on high sulfur naphthas, should crude market conditions make necessary the use of such feeds.

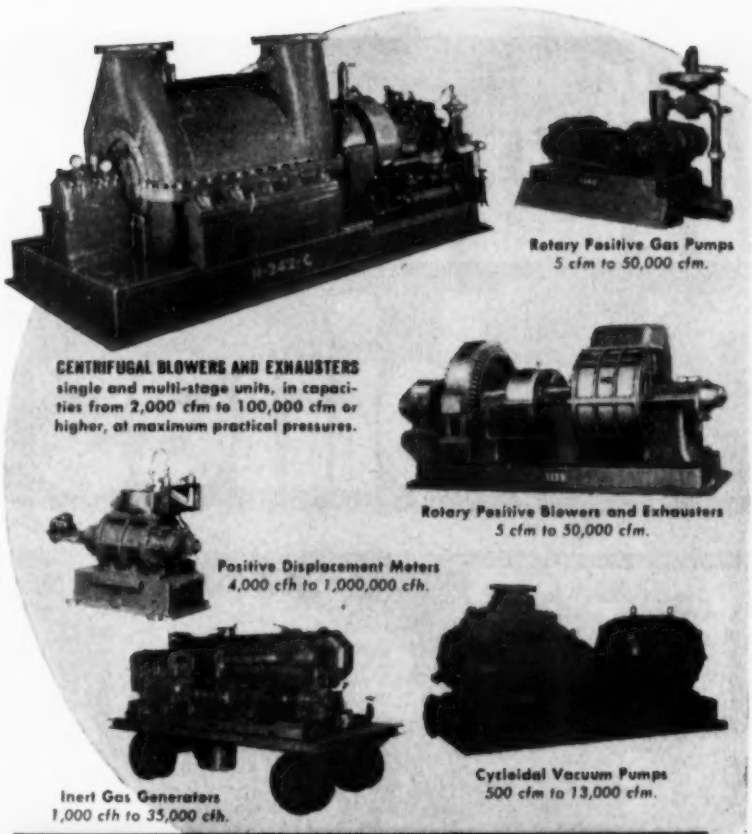
Engineering of the new plant is already underway with construction scheduled to start this fall. Completion of the reformer is expected by the second quarter of 1954. Pure is the second company to announce plans to build a plant using the new catalyst.

SHELL OIL Awards Contract For Elk City Plant Extension

Fluor Corporation, Ltd., has been awarded a contract by Shell Oil Company to build a second major extension to Shell's gasoline plant at Elk City, Okla. The extension will increase the plant's daily rated intake capacity of gas from 150 Mmcf to 225 Mmcf and the gas injection capacity from 135 Mmcf a day to about 210 Mmcf. The work will be completed next spring.

LYNN Announces Plans For New Carbon Black Plant

Plans to construct a carbon black plant 18 miles south of Santa Anna, Calif., in Coleman County, have been announced by Lynn Carbon Black Com-


Rotary Positive Gas Pumps
5 cfm to 50,000 cfm.
CENTRIFUGAL BLOWERS AND EXHAUSTERS
single and multi-stage units, in capacities from 2,000 cfm to 100,000 cfm or higher, at maximum practical pressures.
Rotary Positive Blowers and Exhausters
5 cfm to 50,000 cfm.
Positive Displacement Meters
4,000 cfh to 1,000,000 cfh.
Cycloidal Vacuum Pumps
500 cfm to 13,000 cfm.
Inert Gas Generators
1,000 cfh to 35,000 cfh.

WE *Specialize* IN YOUR PROBLEMS OF MOVING GAS OR AIR!

You may need to move a thimbleful of gas . . . or create a cyclone of whirling air. Whatever your problem, we've probably met something close to it, in experience of almost a century of building such equipment.

Another reason why we know so much about this job is that it's all we do. Our customers range from the "giants of industry" to the neighborhood plant, both of whose production depends upon continuous, reliable, economical performance of air and gas handling units. Because we build the exclusive *dual-ability* line of Rotary Positive and Centrifugal Units, in a wide range of sizes, we offer a *dual choice* which permits completely unbiased recommendations.

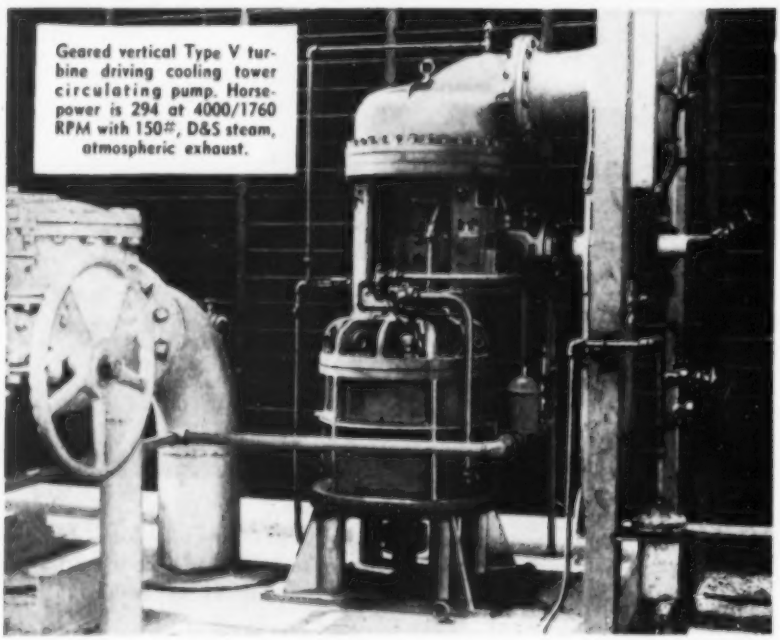
So—if you have a problem today—or anticipate one a year or five years from now, we suggest you call upon the facilities of R-C Specialists. Write for bulletins on any specific equipment.

ROOTS-CONNERSVILLE
Exclusive Specialists in Handling Gas and Air

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC • 253 Crescent Ave. • Connersville, Indiana

Murray Turbines



Geared vertical Type V turbine driving cooling tower circulating pump. Horsepower is 294 at 4000/1760 RPM with 150#, D&S steam, atmospheric exhaust.

● Murray Vertical V turbines, both geared and direct-connected, are being used more and more for driving vertical pumps of all types. The Murray Vertical V turbine is designed from top to bottom as a vertical turbine, not just a horizontal turbine, "upended." The Murray Vertical is especially constructed and arranged for vertical mounting.

Murray vertical turbines can be furnished for steam pressures up to 600#, 750° F. TT. and back pressures as high as 100# and can carry most normal thrust loads imposed by vertical pumps.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

Who's Building . . .

pany, Inc. The new plant, which will have a capacity of 500 Mcf daily, will process all gas from a 3500-acre block in that area.

IROM Venice Refinery Adds Catalytic Polymerization Unit

A catalytic polymerization plant which produces high grade motor spirit from a gas feedstock has been commissioned at the Porto Marghera refinery, near Venice, Italy. The motor spirit from this plant is used for blending with lower grade motor spirit produced by distillation.

This is one of the several new plants installed at Porto Marghera since Anglo-Iranian Oil Company acquired an interest in it in 1948, when the present company, Industria Raffinazione Olii Minerali, was formed jointly by Anglo-Iranian and Azienda Generale Italiana Petroli. During that time the daily capacity has increased from 8000 barrels to 28,000 barrels.

A catalytic cracking unit, which is to be installed at the refinery within the next two years, will also produce high grade motor spirit as well as a gas feedstock for the catalytic polymerization plant.

CARTER OIL to Seek Bids On Fluid Coker Construction

Carter Oil Company expects to ask for bids within the next few days on construction of the world's first commercial fluid coking unit. Now in the design stage, the unit will have a charge capacity of 3000 barrels a day. It will be erected at Carter's Billings, Mont., refinery, and will employ a new coking principle recently announced by Standard Oil Development Company. The new process uses the fluidized solids technique originally developed for cat cracking, adapting it to the thermal cracking of heavy residual fuels which cannot be cat cracked economically.

SINCLAIR Gets Write-Off On Part of Marcus Hook Project

A certificate permitting rapid amortization for a portion of the $14,225,000 expansion project at its Marcus Hook, Pa., refinery has been granted Sinclair Refining Company by the Office of Defense Mobilization. The new construction at the Sinclair refinery includes a 16,000-barrel-a-day catalytic reforming unit, alkylation facilities and new units designed to produce petrochemicals. The reformer, principal unit in the project, will operate with a platinum catalyst developed jointly by Sinclair and Baker & Company, Inc.

TAYLOR Puts on Stream New Corpus Christi Platformer

Taylor Oil and Gas Company has put on stream its second UOP Platformer at its Corpus Christi, Texas, refinery. Designed and licensed by Universal Oil Products Company, the new unit has a design charge capacity of 5000 barrels a day of reactor charge. Taylor constructed the unit.

Taylor's other UOP Platformer, a 4000-barrel-a-day unit, went into operation two years ago. The new unit makes Taylor the first independent refiner to

To current and potential users of fan blown air for cooling

HUDSON PRESENTS ANOTHER MAJOR IMPROVEMENT

the NEW HUDSON HY-FIN DOUBLE TUBE

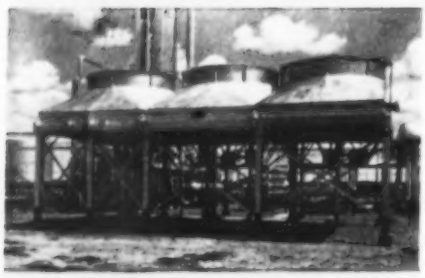
Now employed in HUDSON SOLO-AIRE and HUDSON COMBIN-AIRE units

The HUDSON HY-FIN is made possible through the development at HUDSON'S Houston plant of a special machine to form by cold extrusion from the metal of the tube itself closely spaced, uniform, extremely **high** fins, with integral surfaces of tube and extruded fins being smooth and streamlined.

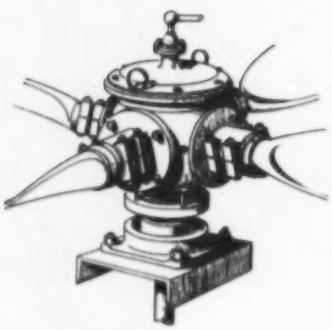
The finned outer tube is usually aluminum alloy, the inner tube may be admiralty, copper, steel, or alloyed steel. The two concentric, snugly fitted tubes with solid mandrel inside the inner tube are fed to the HUDSON HY-FIN machine where tremendous pressures serve to simultaneously extrude most of the metal of the outside tube into high fins, and to form a complete bond between the two tubes.

ADVANTAGES . . . See reverse side

No other hot fluid to air exchanger has all of the following advantages of HUDSON Solo-aire units using HUDSON HY-FIN DOUBLE TUBE



SOLO-AIRE — in which air alone is used for cooling.



AUTO-VARIABLE FAN — automatic variation in fan pitch gives perfect control of cooled fluid temperature and saves horsepower.

COMBIN-AIRE — in which air and water in combination are used for cooling.

1. VERY HIGH HEAT TRANSFER PER LINEAL FOOT OF TUBING. The height of the fins, their extrusion from the tube itself (no crimping or welding), and the perfect bond between tubes, are the reasons.
2. LOW AIR HORSEPOWER REQUIREMENTS. The higher heat transfer rates allow the use of greater spreads between inlet and outlet air temperatures; hence less air mass is moved and less pressure drop encountered for a given heat removal.
3. RUGGED, DURABLE FINS. The strong, integral, smooth fins allow ease in cleaning, and are not susceptible to damage in transit, cleaning, or in operation.
4. ADAPTABILITY. The inner tube may be selected from a variety of materials to best resist corrosion or withstand temperature of the hot fluid. The outer finned tube is resistant to salt air and other atmospheric corrosion, and completely protects the inner tube from such corrosion. HUDSON HY-FIN tubes are in use in oil refinery services cooling corrosive hot fluids at temperatures above 650 °F.
5. UNDIVIDED RESPONSIBILITY. The HUDSON HY-FIN assembly is manufactured from bare tubes by HUDSON and each tube and each step in the manufacture is subjected to rigid inspection to eliminate hidden defects.

The HY-FIN tube is another in the long list of improvements that have resulted from the constant effort to maintain and advance the quality and utility of HUDSON equipment.

HUDSON HY-FIN tubes are manufactured under one or more of three United States Patents. Other patents are pending.

HY-FIN, SOLO-AIRE and COMBIN-AIRE are registered trademarks.

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

have two such units in operation. Construction of the unit was started in the fall of 1952.

UCAN PRODUCTS Awards Delayed Coking Unit Contract

Construction contract for Ucan Products Company's delayed coking unit to be built at Duncan, Okla., in conjunction with Sunray Oil Corporation's catalytic cracking refinery, has been awarded to The Lummus Company. The plant is scheduled for completion late in 1954, and will be owned by Ucan Products.

Function of the new unit will be to produce from a straight run residuum charge material a maximum quantity of gas oil for charging Sunray's catalytic cracking unit.

Designed capacity of the new coking unit is 9000 barrels a day, or, when operating at capacity, approximately 120,000 tons of coke per year.

Ucan has a certificate of necessity to amortise 60 percent of the approximately $3.5 million project investment over a five-year period because the petroleum coke is in high demand.

UNIVERSAL-MATTHEY Plans Catalyst Plant Construction

Construction of a new plant to manufacture platforming catalyst will get underway soon in England. Plans for the new plant were disclosed with an announcement that Universal Oil Products Company has formed a manufacturing subsidiary in conjunction with John Matthey & Company, Ltd., platinum refiners in London. Procon, Ltd., will build the new plant, which is expected to go into production by mid-1954. The new subsidiary is Universal-Matthey & Company, Ltd.

UNION OIL Schedules Construction of New Reformer

A 600-barrel-a-day catalytic reformer and other facilities will be constructed by Union Oil Company of California at its Cut Bank, Mont., refinery. Engineering and design work for the $600,000 project is well advanced, a company spokesman has said.

Construction of the reformer and all auxiliary facilities will be begun early next spring by Ralph M. Parson Company, Los Angeles. All units are scheduled to be in operation by September, 1954.

Plans call for, in addition to the catalytic reformer, modification of the crude distillation tower to produce heavy gasoline as feed for the reformer, rundown lines, transfer pumps, tanks and other facilities needed to make the new unit fully operable.

ARGENTINE AGENCY Moves Ahead on Dehydration Plant

The natural gas branch of the Argentine government's fuels administration is moving forward with plans for a dehydration plant at Plaza Huincul. According to recent reports, Hudson Engineering Company has been contracted to purchase equipment, and arrangements are being made for construction. The plant will handle gas going into the line from Plaza Huincul to General

Pyrene
REG. U.S. PAT. OFF.

AIR FOAM EQUIPMENT

stands watch in oil fields all over the world

Pyrene AIR FOAM

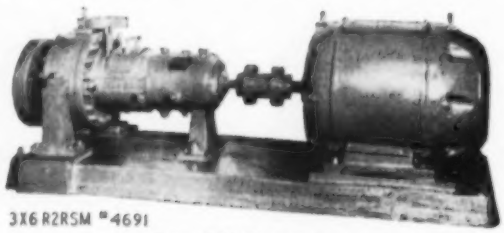
Pyrene* Air Foam Equipment has the reputation of having put out more major oil fires than any other air foam equipment. No matter where or what your fire hazard is, Pyrene can provide you with a built-in air foam system, or portable equipment, that precisely meets your requirements. For complete information, or the help of a Pyrene engineer, write us today.

*T.M. Reg. U.S. Pat. Off.

PYRENE MANUFACTURING COMPANY
682 Belmont Avenue, Newark 8, New Jersey
Affiliated with C-O-Two Fire Equipment Co.
The Pyrene Company Limited, England
Pyrene Manufacturing Co. of Canada, Limited

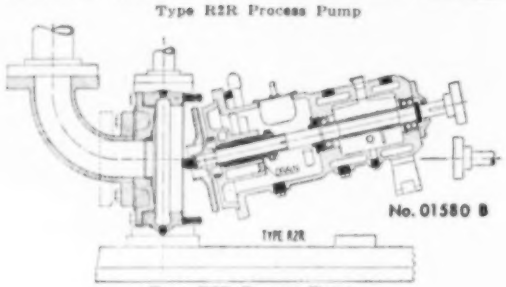
DEAN BROTHERS PUMPS INC.

Type R2R Centrifugal Process Pumps



3X6 R2RSM #4691

Type R2R Process Pump



Type R2R Process Pump

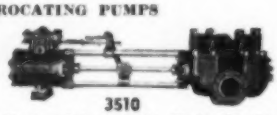
DISASSEMBLY: The Type R2R process pumps can be disassembled without disconnecting the suction and discharge piping. By first removing the spacer from the spacer type coupling, and unbolting the casing from the cradle the entire cradle and complete rotating element can be removed without disturbing the suction and discharge piping.

OPERATING RANGE: Type R2R, Heavy duty, process pumps are available in eighteen different sizes, enabling our engineers to furnish units specially designed and constructed for the particular work to be performed.
Capacities: 50 to 2000 Gallons per minute. Heads: Up to 400'. Speeds: 900 RPM to 4000 RPM.

BUILDERS OF OUTSTANDING PUMPS SINCE 1869

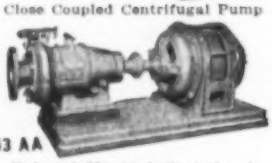
CENTRIFUGAL and RECIPROCATING PUMPS

Close Coupled Centrifugal Pump



3510

Horizontal, Single Style, Double Acting, Piston Type, Close Clearance Pump. Designed to handle volatile liquids

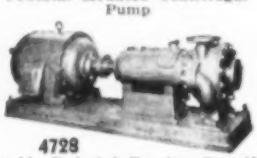


4043 AA

Pedestal Mounted Centrifugal Pump

3833

Horizontal, Duplex, Double Acting, Side Pot, Piston Type, Oil Bath Power Pump



4728

Double Pedestal Bearing Centrifugal Pump

3556

Durable Duplex Packed Piston Pattern Steam Pump, Side Pot Type

ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.

INDIANAPOLIS IND.

323 W TENTH ST

Branch Offices: NEW YORK, N. Y., HOUSTON, TEXAS

Representatives in Principal Cities

Who's Building . . .

Conesa. At the latter point, the line joins the main line from Comodoro Rivadavia to Buenos Aires.

PETROFINA Contracts for 20,000-Barrel Montreal Plant

Contracts for construction of a 20,000-barrel-a-day refinery in the Montreal area of Quebec for Canadian Petrofina, Ltd., will be split between The M. W. Kellogg Company and Lummus Company. Canadian Petrofina is a subsidiary of Compagnie Financiere Belge des Petroles S.A.

A company spokesman has said that a 20,000-barrel-a-day thermofor catalytic cracking unit probably will be included in plans, along with a primary distillation unit, a catalytic polymerization plant, a vacuum distillation unit, a catalytic reforming unit and a hydrodesulfurization unit. Plans also include auxiliary and related facilities. Completion is scheduled for late 1955. Estimated cost is $20 million.

Crude supply for the installation will probably come from Middle East or Venezuela, with a shift to Canadian crude being made at a later date "if and when it becomes economically available."

TEXAS EASTMAN to Build New Synthetic Hard Wax Plant

Plans to build a $3.8 million synthetic hard wax plant in connection with its polyethylene works at Longview, Texas, have been announced by Texas Eastman Company. The announcement follows closely ground-breaking ceremonies for the company's $7 million polyethylene plant. Output of the synthetic wax plant will amount to several million pounds annually.

CALIFORNIA STANDARD Operating Paraxylene Plant

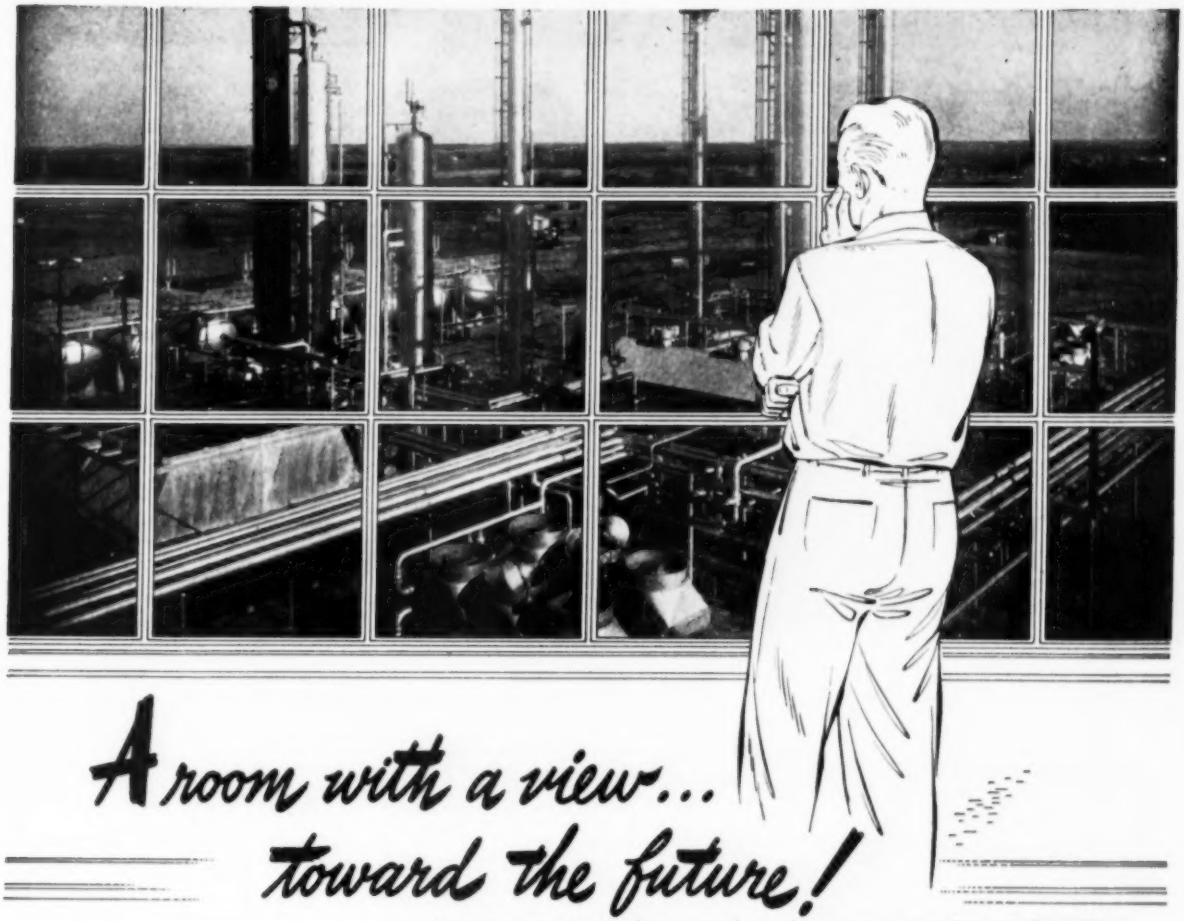
Commercial shipments have begun from Standard Oil Company of California's new paraxylene plant at El Segundo, Calif. Built in record time, the plant is part of a multimillion dollar expansion program designed to set up production of petrochemicals at the El Segundo refinery. Output of the installation is to be marketed through Oronite Chemical Company of San Francisco.

SURE-SEAL Starts Work on Salt Lake City Wax Refinery

Construction of a $2 million wax refinery north of Salt Lake City has been started by Sure-Seal Corporation. The refinery is being constructed on a 20-acre plot in south Davis County near the Phillips Petroleum Corporation's refinery. The Sure-Seal plant is being transported from Dallas, Texas, where it was purchased after it had been in operation only a few months.

AMSTERDAM FIRM Completes Construction of Catalyst Plant

A new plant for the manufacture of microspheroidal aluminum catalyst has been completed in Amsterdam in the Netherlands. The plant was built at the Royal Sulfuric Acid Works, which is manufacturing the catalyst under license from American Cyanamid Company. American Cyanamid supplied technical assistance for the project. Construction was begun late in 1951.



A room with a view... toward the future!

Plant superintendents and maintenance engineers MUST look to the future. They have the tough job of handling *today's* problems and anticipating tomorrow's. For instance . . . if a heat exchanger is showing signs of excessive corrosion the maintenance superintendent must see that repair or replacement is made BEFORE prolonged shut-down becomes necessary. It's a tough job and that's why many of these men have come to rely on Western Supply Company for assistance in all heat transfer problems. Western offers the trained help of an experienced staff of heat exchanger engineers to consult with YOU on all YOUR heat transfer problems. It is this SERVICE plus Western's close adherence to rigid engineering specifications that have made the big Western "W" a familiar trademark in refining and processing plants all across the nation. The NEXT time . . . CHECK WITH WESTERN.

WESTERN
HEAT EXCHANGERS
Manufactured by
WESTERN SUPPLY COMPANY
P. O. BOX 1688 TULSA, OKLAHOMA

Also at **WESTERN . . .**

Nordstrom Valves
Taylor Fittings and Flanges
Chapman Valves
Crane Valves

NOW...fast, accurate transmission of DIFFERENTIAL PRESSURE MEASUREMENT with the Ashcroft Pneumatic Transmitter

Thousands of Ashcroft Pneumatic Transmitters are accurately measuring *straight pressures* in processing plants everywhere. Now, coupled with an exceptionally rugged differential pressure cell, the Ashcroft Transmitter assures the same standard calibrated accuracy of ½ of 1% in measuring *differential pressures.*

The Ashcroft Pneumatic Transmitter with Differential Pressure Cell is ideal for oil refineries, chemical plants or wherever it is good safety engineering to confine inflammable, poisonous or corrosive liquids or gases close to their source—away from control centers.

This new combination provides a durable and dependable system suitable for static pressures up to 4500 psi. It operates on low-pressure air—transmits proportionate air pressure to one or more pressure-actuated receiving indicators, recorders and controllers up to 1000 feet away. Response is fast—only 3 to 10 seconds for full scale change.

Installation is easy and economical. Low-cost, small-diameter piping is used. You avoid expensive high-pressure lines and fittings and all their leakage and maintenance problems.

Learn all about the basic types and differential pressure ranges in which the Ashcroft Pneumatic Transmitter with Differential Pressure Cell can be supplied. Write for Bulletin 330.

1850 ASHCROFT U.S.A.

YOUR INSTRUMENT DISTRIBUTOR makes it his business to keep up with all that's new in process equipment. Call on him for practical counsel, efficient service and products you can depend on to save time, effort and money.

ASHCROFT GAUGES

MAXWELL MANNING & MOORE JR.

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'ASHCROFT' GAUGES, 'HANCOCK' VALVES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

PAN-AM SOUTHERN to Build New Hydroformer at El Dorado

A fixed-bed hydroforming unit incorporating latest design features will be built at the El Dorado, Ark., refinery of Pan-Am Southern Corporation. Construction will start this month.

The unit will be one of the first of its kind in the U. S. and will incorporate a catalyst developed by the Research department of Standard Oil Company (Indiana), Pan-Am's parent company. Units of similar design are also under construction at the Texas City, Texas, refinery of Pan American Refining Corporation and the Wood River, Ill. refinery of Standard of Indiana.

The Lummus Company will build the new hydroformer. Athough definite schedules have not been worked out, plans call for completion of the unit sometime next summer.

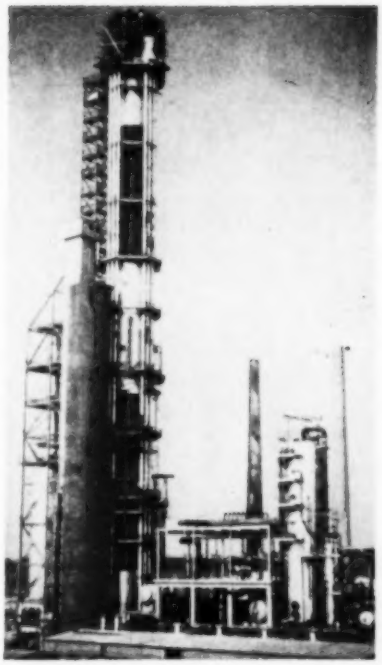
The unit will be erected next to the No. 2 fluid catalytic cracking unit at the end of El Dorado's refinery row. Purpose of the unit is to convert low-octane naphtha into high-octane hydroformate for blending into Pan-Am's Balanced Energy gasoline.

The hydroformer lends itself to conversion for production of certain petrochemicals such as benzene and toluene. Since the El Dorado refinery already produces propylene tetramer and polybutene, this new unit strengthens the installation as a producer of petrochemicals in the future should the need arise. However, no operation of this type is planned.

SUNTIDE Ahead of Schedule On Refinery Construction Job

Crude oil processing stills for the production of gas oil have been put in operation at Suntide Refining Company's nearly completed catalytic cracking refinery at Corpus Christi, Texas. The company is running ahead of schedule in completion of principal oil processing units of the project.

The cat cracker is actually 75 percent complete. Onsite construction of fractionators, cycle oil strippers, air blowers, steam generators and all exchangers is complete and all pumps are on foundations. Construction of the alkylation unit has started and is about 25 percent complete, as is the vapor recovery unit. The treating and blending section of the new Suntide plant is completed, and the polymerization unit equipment is in place and being hooked up. Completion of the entire project is scheduled for late November.



First German Houdriflow—

A 17,500-barrel-per-day Houdriflow catalytic cracking unit (pictured above) has gone on stream at the Gewerkschaft Erdoel-Raffinerie Emsland refinery in Lingen, Germany.

Financed partly with MSA funds it is the principal processing unit in a completely new refinery. The unit is designed to treat and partially de-sulphurize light coker and straight-run distillate products. The refinery currently processes a mixture of Georgsdorf and Emlichheim crudes.

A Lummus coking unit constitutes part of the feed preparation section for the Houdriflow unit. Total vaporizable effluent from the coker flash tower passes directly to the cracking tower together with gas oils from the topping plant. This integrated arrangement eliminates intermediate storage, thereby reducing operating and equipment costs.

Houdry Process Corporation designed and licensed the catalytic unit. Engineering and construction of the plant was handled by The Lummus Company.

WHO'S Building . . .

PAN AMERICAN Tops Latest ODM Tax Write-Off List

Heading the latest list of expansion projects and basic refining plans approved for rapid tax amortization by the Office of Defense Mobilization is the fast tax write-off granted Pan American Refining Corporation. On its $2.9 million 2960-barrel-a-day alkylation unit to be installed in a proposed refinery at Goodwin Neck, Va., the company was given 100 percent certification. In addition, it received 45 percent certification for $280,000 in auxiliary facilities.

Second among approved projects was Tide Water Associated Oil Company's $2,175,000 basic refinery expansion at Avon, Calif. Tide Water had $875,000 certified at 65 percent, and $425,000 at 45 percent.

Other oil projects approved for fast tax write-off by ODM, with name of company, location of facility, type of facility, total cost, percentage certified, were:

Barnhart Hydrocarbon Corporation—Big Lake, Texas, isobutane separator to recover 7500 gallons daily; $91,400; $82,650 at 100 pgrcent; $8750 at 65 percent.

Moran Gasoline Corporation—Chandler, Okla., natural gasoline plant to recover 700 gallons a day of propane, 80,000 gallons a day of butane, and 10,000 gallons a day of natural gasoline; $488,100; $425,000 at 65 percent; $62,300 at 40 percent.

LION OIL Pushes Work on $5 Million Refinery Expansion

Construction on a $5 million expansion program at its El Dorado, Ark., refinery is being pushed by Lion Oil Company. The project calls for erection of a new catalytic cracker, an alkylation unit, vapor-recovery plant, and various auxiliary facilities. Company officials report that foundations have been laid and necessary equipment and materials for the new units have arrived. All the facilities are expected to be completed and on stream within three months. The refinery's crude-charging capacity will be increased by 1500 barrels a day by the project.

ESSO STANDARD Dedicates Fluid Cat Cracker at Everett

A 24,000-barrel-a-day fluid catalytic cracking plant has been dedicated by Esso Standard Oil Company at its Everett, Mass., refinery.

CONSTRUCTION BOXSCORE: Refineries and Other Plants

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
EAST									
Allied Chemical	Hopewell, Va.	Syn. Nitrogen	150,000 tons yr.	$12.5 million					
Allied Chem. & Dye	Buffalo, N.Y.	Aromatic Fac.		$6,940,000	PAD Certified				
Atlantic Refining Co.	Philadelphia, Pa.	Detergent Mfg.		$1.5 million	Completed			Atlantic	Ferguson
Atlantic Refining Co	Philadelphia, Pa.	Cat. Reform.	11,000 bbls.	$4 million	Completing		Atlantic	Badger Div.	Badger Div.
Atlantic Refining	Philadelphia, Pa.	Two stage pipe still, Cat: Alky: Poly Units	50,000 bbls.	$5.6 million	Completing				Badger Div.
Atlantic Refining	Philadelphia, Pa.	Orthoflow Cat. Cracking	45,000 bbls.		Completing			Kellogg	Kellogg
Atlantic Refining	Philadelphia	Two Stage Crude Dist.	45,000 bbls.		Under Constr.			Foster Wheeler	Foster Wheeler
California Oil Co	Barber, N.J.	Revamp Thermal Reformer to Cat. Reformer	10,700 bbls		Under Constr.	1954	U.O.P.	U.O.P.	Bechtel

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Dewey & Almy Chemical Co.	Acton, Mass.	Synthetic Rubber Addition		$700,000	Completed			Staff	Blake Constr.
E. I. du Pont de Nemours	Kinston, N.C.	Dacron Polyester Fiber		$3,000,000	Planning	1954			
Esso Standard	Everett, Mass.	Fluid Cat. Crk.	†18,500 bbls.		Completed			S.O.D.	Foster Wheeler
Esso Standard	Everett, Mass.	Propane Plt.	870 bbls.		Announced	2nd Qtr., 1954		S.O.D.	
Esso Standard	Linden, N.J.	Crude Pipe Still	60,000 bbls.		Under Constr.	2nd Qtr., 1954		S.O.D., Kellogg	Kellogg
Esso Standard	Bayonne, N.J.	Wax Pipe Still	3,500 bbls.		Under Constr.	End 1953		S.O.D., Fluor	Fluor
Esso Standard	Linden, N.J.	Hydrofining	21,500 bbls.		Announced	4th Qtr., 1954		S.O.D., Braun	Braun
*B. F. Goodrich Chemical Co.	Calvert City, Ky.	Chemical Plt.		$8,000,000	Engineering	4th Qtr., 1954		Fluor	Fluor
Gulf	Philadelphia	Crude; Atoms. & Vacuum Unit	125,000 bbls.		Under Constr.	Spring, 1954		Foster Wheeler	Foster Wheeler
Gulf Oil Corp.	Philadelphia	Sulfur Recovery		$1.1 million	DPA Certified				
Gulf	Philadelphia	Gasoline Sweet	40,000 bbls.		Under Constr.	Spring, 1954		Gulf	Gulf
Gulf	Philadelphia	Cat. Poly.	10,000 bbls.		Under Constr.	Early, 1954		Bechtel	Kellogg
Gulf	Philadelphia	Cat. Cracker	63,000 bbls.		Under Constr.	Early, 1954		Kellogg	Kellogg
Hercules Powder	Gibbstown, N.J.	Petrochemicals		$8 million	Under Constr.	Jan., 1954		Kellogg	Kellogg
Mathieson Hydrocarbon Chemical	Brandenburg, Ky.	Chemical Plt.		$17 million	Under Constr.			Badger Div.	Badger Div.
Monsanto	Springfield, Mass.	Polyvinyl chloride resin		$1.2 million	Announced				
*Pan American Refining Corp.	Pedricktown, N.J.	Refinery		$25,000,000	ODM Approved				
Pennsylvania Industrial Chemical Corp.	Jefferson, Pa.	Petrochem. Plt.			Under Constr.	Summer 1954			
*Pennzoil Co.	Rouseville, Pa.	Expan. Two-Stage Distil.	12,000 bbls.						Kellogg
Sinclair Refining	Marcus Hook, Pa.	Cat. Reforming	16,000 bbls.	$14,000,000	Projected	Summer, 1954			Braun
		LPG Expan.	900 bbls.	$1,000,000	Under Constr.	End, 1953			
Socony-Vacuum	Paulsboro, N.J.	Alkylation Exp.			Under Constr.	Dec., 1953		Soc-Vac.	Soc-Vac.
Socony-Vacuum	Paulsboro, N.J.	TCR Catalyst			Complete		Soc-Vac	Bechtel	Bechtel
Sun Oil Co.	Marcus Hook, Pa.	Naphthenic Acid & Sulfonate Extraction Unit	1,250 bbls.	$1,800,000	Completing			Sun-Texas Eng.	Sun
Sun Oil Co.	Marcus Hook, Pa.	Aromatics Rec., Houdriformer	10,000 bbls.	$8.7 million	Completed		Houdry & U.O.P.	Sun	Sun
Texas Company	Westville, N. J.	Cat. Reforming	12,000 bbls.		Under Constr.	4th Qtr., 1954			
		Alkylation Fac.	1,850 bbls.		Under Constr.	4th Qtr., 1954			
Union Carbide & Carbon Corp.	Leakesville, N.C.	Dyned Fiber Plt.		$30,000,000	Planning	1955		Staff	
United Refining Co.	Warren, Pa.	Cat. Reform. Plt.	2,500 bbls.		Completing		Atlantic	Blaw-Knox	Blaw-Knox
United Refining Co.	Warren, Pa.	Lab.			Under Constr.				
United Refining	Warren, Pa.	Treating Fac.	750 bbls.		Completing			Blaw-Knox	Blaw-Knox
MID-CONTINENT									
Allied Chemical & Dye Corp.	South Point, O.	Synthetic Nitrogen	50,000 tons yr.	$12.5 million	Design				
Allied Chemical & Dye	Cleveland, Ohio	Chemical Plt.		$2,000,000	Under Constr.	1954		Staff	M-C & S.
Amerada Pet. Corp.	Williston, Basin, N. D.	Natural Gasoline Plt.		$10 million	Planning				
Ashland O&R	Canton, Ohio	Tankage, Misc.		$500,000	Completing			Staff	Staff
Aurora Gasoline	Detroit, Mich.	Basic Refining		$400,000	Announced				
*The Carter Oil Co.	Billings, Mont.	Fluid Coking Unit	3,000 bbls.		Design	Late 1954	Std. Oil Dev. Co.		
Central Petroleum Co.	Coyle ,Okla.	Gasoline Plt.			Authorized				
Champlin Refining Co.	Enid, Okla.	Cat. Reformer			Considering				
Cities Service Oil Co. (Del.)	E. Chicago, Ind.	Topping Unit, Fluid Hydroformer	30,000 bbls. 12,780 bbls.	$2 million $4 million	Under Constr. Under Constr.	1954 1954		McKee Kellogg	McKee Kellogg
	Kans.								
Continental Blacks, Inc.	Ponca City, Okla.	Carbon Black Plt.	140,000 lbs.	$2,715,175	Under Constr.	Early, 1954		Fish	Fish
Continental Oil	Ponca City, Okla.	Expansion	None	$7.5 million	Under Constr.	1954	Continental	Staff	Staff
Cooperative Farm Chemicals Assn.	Lawrence, Kans.				Under Constr.	August, 1954	Texaco Dev., Casale	Foster Wheeler	Foster Wheeler
Cooperative Refinery Assoc.	Phillipsburg, Kans.	Increase Cap. Vacuum Unit	8,000 bbls., 3,500 bbls.	$1,050,000	Completing			Staff & U.O.P.	Staff
Deere & Company	Pryor, Okla.	Ammonia Plt.	180 tons		Under Constr.	Spring, 1954	Texaco Dev.	Foster Wheeler	Foster Wheeler
		Urea Plt.	270 tons					Foster Wheeler	Foster Wheeler
Detroit Chem. Wks.	Detroit, Mich.	Sulfuric Acid		$950,000	PAD Certified				
Dow Chemical	Midland, Mich.	2nd Hypersorption Unit			Under Constr.		Union Oil (Calif.)	Foster Wheeler	Foster Wheeler
Dow Chemical	Ludington, Mich.	Bromine for TEL	2 million lbs. yr	$433,500	Under Constr.				
Dow Chemical	Midland, Mich	Ethylene Dibromide		$370,000	Under Constr.				
E. I. DuPont de Nemours	Circleville, Ohio	Mylar Polyester Plt.		$10,000,000	Under Constr.	Early, 1955			
Globe Oil & Refg.	Lemont, Ill.	Alkylation Unit, Cat. Crker.	5,000 bbls. 10,000 bbls.	$4 million	Under Constr. Under Constr.	April, 1954 April, 1954	Phillips U.O.P.	Koch Staff	Staff Staff
Grace Chemical	Memphis, Tenn.	Ammonia Plt., & Urea	250 tons		Under Constr.	Summer, 1954	Texaco Dev., Casale & Pechiney	Foster Wheeler	Foster Wheeler
Great Northern	St. Paul, Minn.	Crude Topping	30,000 bbls.						
Great Northern Oil	St. Paul	Cat. Crk.	7,620 bbls.	$26 million	Planned				
Great Northern	St. Paul	Cat. Reformer	6,000 bbls.						
Great Northern	St. Paul	Cat. Poly.	680 bbls.						
Gulf Oil	Cincinnati, Ohio	Canning Plt.			Announced				
Hooker Electro-Chemical Co.	Montague, Mich.	Chlorine Caustic		$12 million	Under Constr.	4th Qtr., 1953		Staff	Ferguson
Leonard Refineries	Alma, Mich.	Vacuum Unit	4,500 bbls.		Completed		Amer. Dev.	Ref. Eng.	Ref. Eng.,
		Treating Unit	6,000 bbls.		Completed			Amer. Dev.	Staff
		Propane Trtg.	200 bbls.		Completed				
Lion Oil	El Dorado, Ark.	Cat. Crk. Unit	5,000 bbls.	$5 million	Completing		Kellogg	Lummus	Lummus
Lion Oil	El Dorado, Ark.	Alkylation Plt.	1,150 bbls.		Completing		Texaco Dev.		
Michigan Chem.	St. Louis, Mo.	Sulfuric Acid		$81,681	PAD Certified				
Mid-Continent Petroleum	W. Tulsa, Okla.	Cat. Reformer	7,500 bbls.	$2,500,000	Under Constr.	June, 1954	Atlantic	Kellogg	Kellogg
	W. Tulsa, Okla.	Alkylation Exp.	500 bbls.	$433,428	Complete				
Minnesota Mining	Copley Twp., Ohio	Sulfuric Acid Fac.		$2.1 million	Under Constr.				
Mississippi Chemical Corp.	Yazoo City, Miss.	Increase Cap. of Ammonia Plt.	160 tons	$2,000,000	Under Constr.	Early, 1954	L'Air Liquide	Girdler	Girdler
*Mississippi Chemical	Yazoo City, Miss.	Ammonia Plt.	60 tons	$2,500,000	Proposed	Late, 1954	L'Air Liquide	Staff	
*Mississippi Chemical	Yazoo City, Miss.	Nitric Acid Plt.	120 tons	$575,000	Engineering Started	Early, 1954	du Pont	Chemical & Industrial	Chemical & Industrial

Table Continued on Page 193

Fractions
SOLVE BIG PROBLEMS

The petroleum industry has made good use of the "divide-and-rule" formula that conquered kingdoms . . . to win command of the giant powers hidden in nature's oil. The industry's process engineers have transformed American life by their mastery of petroleum's secrets . . . and fractionating has been their master key.

These engineers' ability to develop processes which break petroleum into its component fractions has harnessed the "black gold" into a myriad forms of service. There have been other important results, too. The gigantic motor industry . . . America's vast network of modern highways . . . the services to motor travel—these are largely by-products of the petroleum process engineer's knowledge of fractional distillation.

For many years, Sun Ship has been adding to its own prestige by the service and cooperation its great shops give to the petroleum industry, and to the many other industries which call on Sun Ship's versatile engineering and construction skills. It has built . . . for chemical and petroleum process engineers, and for refineries throughout the world . . . the immense fractionating towers, pressure vessels, special machinery and heavy equipment they require. The 95'7" crude tower shown in the photograph, ready for shipment, is a representative example.

Sun Ship's services will continue to keep pace with the giant strides made by the nation's industries in the engineering progress which is steadily building a greater America.

Sun

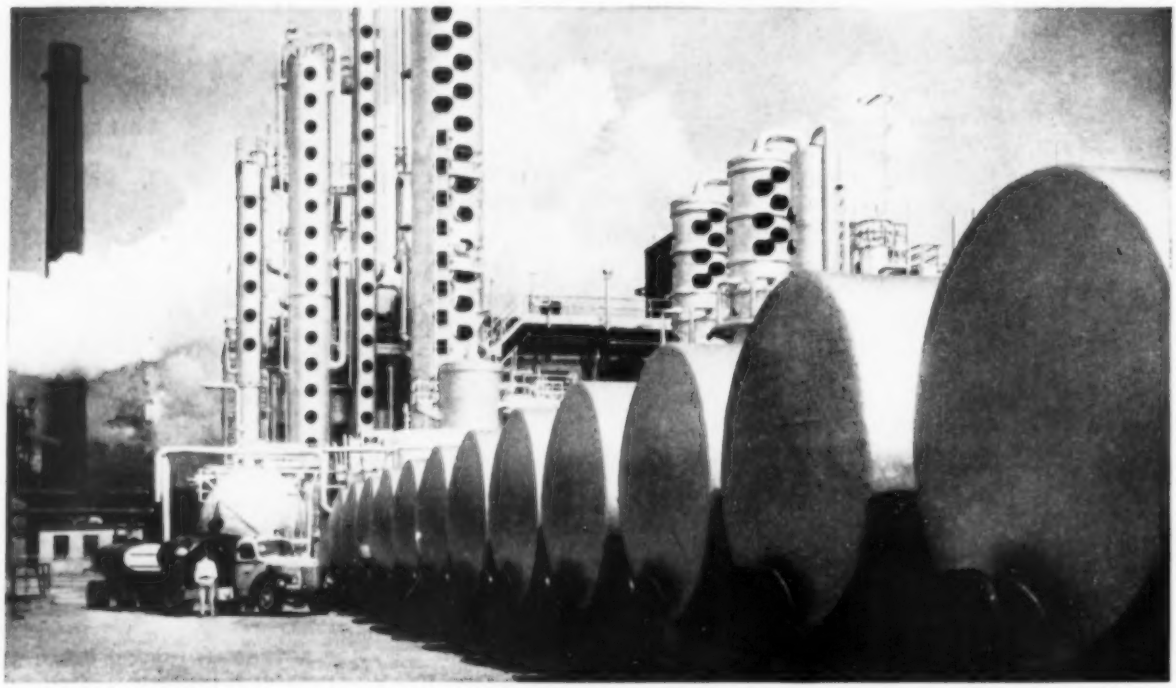
SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE (SINCE 1916) **CHESTER, PA.**

25 BROADWAY • NEW YORK CITY

TANKS PREPARED FOR ALCOHOL STORAGE BY CHEMICAL CLEANING

Dowell Service removed all traces of oil after mechanical cleaning method failed



Can you imagine cleaning out oil storage tanks so well that they could be used to store a product such as alcohol, which is so easily discolored by oil and grease?

That's exactly what Dowell did for a customer who wanted to convert three 350,000 gallon tanks from oil to alcohol storage.

Previous attempts to clean the tanks by sand blasting had not been satisfactory. And there was particular difficulty in cleaning behind the overlapping plates of one riveted tank.

Dowell Service did the job in about 10 hours per tank with this result: *the tanks were completely free from oil and grease.* Dowell furnished all trained personnel, chemical solvents, high pressure jets, pump trucks and controls.

Tank cleaning, including removal of paint from external surfaces, is just one of hundreds of applications for Dowell Service using chemicals for maintenance cleaning. For complete information and estimates on the cleaning of your equipment, call the nearest Dowell office, or write directly to Tulsa, Dept. J31.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers · Condensers · Heat Exchangers · Cooling Systems
Pipe Lines · Piping Systems · Gas Washers · Process Towers
Process Equipment · Evaporators · Filter Beds · Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED · TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
*Mississippi Chemical	Yazoo City, Miss.	Prilled Ammonium Nitrate	400 tons	$600,000	Planning	Middle 1954		Staff	
Mississippi River Fuel Corp.	St. Louis, Mo.	Petrochem. Fac.			Proposed				
Missouri Farmers Association	Joplin, Mo.	Fertilizer Plt.	220 tons	$3,500,000	Under Constr.	1954		Dorr Co.	M-C & S.
Monsanto Chemical	Addyston, Ohio	Styrene Plastics			Plan				
National Cooperative Ref. Assoc.	McPherson, Kans.	Coker	10,000 bbls.	$1,200,000	Completing		U.O.P. doing Process Specif.	Ref. Eng.	Ref. Eng.
National Distillers Products	Tuscola, Ill.	Synthetic Ammonia Plt.	30,000 tons/yr.	$7,000,000	Planned	End 1954		Kellogg	
National Petro-Chemicals	Tuscola, Ill.	Hydrocarbon Rec.	450,000 gals/day	$45,000,000	Completing			Pritchard	Pritchard
		Ethylene	300 tons/day		Completing			Lummus	Lummus
		Ethyl Alcohol	50 million gals/yr.		Completing			Vulcan	Pritchard
		Ethyl Chloride	50 million lbs/yr		Completing				
Ohio Oil Company	Robinson, Ill.	Houdriforming	8,000 bbls.		Under Constr.	March, 1954	Houdry	Foster Wheeler	Foster Wheeler
Ohio Oil	Robinson, Ill.	Cat. Cracker Expansion	18,000 bbls.		Under Constr.	May, 1954		Staff	Cat. Constr. Staff
		Cat. Poly Expan	4,800 bbls.		Planning	May, 1954		Staff	Staff
		Alkylation Unit	1,500 bbls.	$1,800,000	Contracted		U.O.P.	Parsons	Parsons
Oklahoma Refg. Co.	Seminole, Okla.	Refinery	200 bbls.	$40,000					
Pana Refining Co.	Pana, Ill.	Modernization	†1,600 bbls.	$900,000					
Pana Refining	Pana, Ill.	Girbotol Unit			Under Constr.				Parker
*Pan-Am Southern	El Dorado, Ark.	Fixed-Bed Hydroform. Unit			Under Constr.	Summer, 1954	Standard (Ind.)		Lummus
Pennsylvania Salt	Wyondotte, Mich.	Ammonia Plt.	55 tons		Complete			Foster Wheeler	Foster Wheeler
Petroleum Specialties	Flat Rock, Mich.	Visbreaker	2,500 bbls.		Completing				
*The Pure Oil Co	Heath, Ohio	Cat. Reformer	3,000 bbls.		Under Constr.	2nd Qtr., 1954			
Pure Oil	Toledo, Ohio	Alkylation Unit (Sulfuric Acid)		$2.5 million	DPA Ok'd Planning				Kellogg
Pure Oil	Toledo, Ohio	Modernization	30,000 bbls.		Completed			Kellogg	Kellogg
Pure Oil	Toledo, Ohio	Orthoflow Cat.	15,000 bbls.		Completed			Kellogg	Kellogg
Queen City Refinery, Inc.	Dickinson, N. Dak.	Refinery			Site Purchased				
R. J. Oil & Refining	Princeton, Ind.	Platform. Unit	600 bbls.		Completed		U.O.P.	Procon	Procon
Shallow Water & Refining	Shallow Water, Kans.	Cat. Cracker & Auxiliaries	3,000 bbls. (Gas Oil Charge to Cat. Cracker)	$1,700,000	Planning	Late, 1954			
*Shell Oil Co.	Wood River, Ill.	Offsite Fac.			Under Constr.	4th Qtr., 1954		Fluor	Fluor
Shell Oil	Wood River, Ill.	Expansion and Improvement	†50,000 bbls.	$42.5 million	Under Constr.	Late 1954		Shell	Foster Wheeler, Fluor & McKee
Shell Oil Company	Wood River, Ill.	Platforming Unit	16,000 bbls.		Under Constr.	Feb., 1954	U.O.P.	U.O.P.	Procon
Shell Oil Co	Elk City, Okla.	Cap. Increase	†70 Mmcf.					Fluor	Fluor
Signal Oil Co.	Tioga, N.D.	Nat. Gaso. Plt.	40 Mmcf.	$15,000,000	Projected	Fall, 1954		Pritchard	Pritchard
Sinclair Refining	Hartford, Ill.	Asphalt Fac.		$600,000	Design	Spring, 1954			
Sinclair Refining	E. Chicago, Ind.	Barrel House Fac.		$2,700,000	Design	Summer, 1954			
Sinclair Refining	E. Chicago, Ind.	Power Plt. Addi.		$570,000	Design	Summer, 1954			
Sinclair Refining	E. Chicago, Ind.	Gaso. Fract. Unit	20,000 bbls.	$1,300,000	Under Constr.	Fall, 1954			
Skelly Oil	Velma, Okla.	Booster Station			Planned				
Socony-Vacuum	Trenton, Mich.	Cat. Poly. Unit			Design	Dec., 1953	Calif. Res.	Badger	Badger
Socony-Vacuum	Augusta, Kans.	T C R	3,000 bbls.	$3 million	Under Constr.	Jan., 1954	Soc-Vac.	Bechtel	Bechtel
Socony-Vacuum	E. St. Louis, Ill.	Alky. Expan.	775 bbls.	$260,000	Design	June, 1954		Soc-Vac	Soc-Vac
Socony-Vacuum	E. St. Louis, Ill.	TCC	15,000 bbls.		Design	June, 1954	Soc-Vac.	Lummus	Lummus
Socony-Vacuum	E. St. Louis, Ill.	Cat. Poly.			Design	June, 1954		Lummus	Lummus
Sohio Petroleum Co.	Elmore City, Okla.	Gasoline Plt.	10 Mmcf.		Completing			Born Eng.	Born Eng.
Spencer Chemical Company	Vicksburg, Miss.	Petrochemical	200 tons	$14 million	Completing		Texaco Dev.	Foster Wheeler, Staff	Foster Wheeler, Quaker Valley
Standard-Indiana	Wood River, Ill.	Fluid Hydroformer	9,000 bbls.		Design	Late 1954			
Standard-Ind.	Wood River, Ill.	Alcohols Prod.	30,000 lbs.	$2.6 million	Complete				
Standard (Indiana)	Mandan, N.D.	New Crude Ref.	30,000 bbls.		Under Constr.	3rd Qtr., 1954			Lummus
Standard (Indiana)	Whiting, Ind.	Hydroformer	24,000 bbls.		Design	Early, 1955			
Standard (Indiana)	Whiting, Ind.	Para-Xylene	38,400 bbls.		Design	Late 1954			
*Standard (Indiana)	Whiting, Ind.	Motor Oil Exp.	21,600 gals.		Design	Late, 1954			
Standard Oil of N.D.	Grand Forks, N. Dakota	Refinery	2,000-2,500 bbls.		Planning				
Standard (Ohio)	Lima, Ohio	Operating Units for Cat. Ref.		$4,000,000	Under Constr.	May, 1954			Procon
The Standard Oil Co. (Ohio)	Lima, Ohio	Platformer	12,000 bbls.	$8 million	Under Constr.	May, 1954		U.O.P.	Procon
Standard (Ohio)	Cleveland, Ohio	Crude Topping	7,000 bbls.	$4,200,000	Design	Mid, 1954			
		Cracker; Poly	18,000 bbls.						
		Cat. Reforming	3,000 bbls.	$8.5 million	Engineering	Mid 1954			
Stanolind Oil & Gas Company	Tulsa, Okla.	Research Center			Completing			Shreve, Lamb & Harmon	Manhattan
Sterling Oil of Okla., Inc.	Garfield Co., Okla.	Gaso. Ext. Plt.			Planning				
Sterling Oil of Okla.	Oklahoma Co., Okla.	Gaso. Ext. Plt.			Planning				
Sun Oil	Toledo, Ohio	Platform Unit	10,000 bbls.	$7.2 million	Completing		U.O.P.	Procon-Sun	Procon-Catalytic
Sun Oil Co.	Toledo, Ohio	Gas Plt.			Projected	Indefinite		Catalytic	Catalytic
*Sunray Oil	Duncan, Okla.	Platforming Unit	5,000 bbls.	$1,300,000	Engineering	Aug., 1954	U.O.P.	U.O.P.	
Sunray Oil	Duncan, Okla.	Coking Unit	9,000 bbls.	$4,000,000	Engineering	Oct., 1954		Lummus	Lummus
*The Texas Co	Lawrenceville, Ill.	Cat. Reformer	13,631 bbls.		Constr. to start 1st Qtr., 1954	2nd Qtr., 1955			
	Lawrenceville Ill.	Alkylation Unit	2,253 bbls.		Constr. to start 1st Qtr., 1954	2nd Qtr., 1955			
Texas Co.	Sunburst, Mont.	Cat. Poly. Unit	37,200 bbls.		Engineering	Late 1953			
Warren Petroleum	Antioch, Okla.	Nat. Gaso. Plt.	18,000 Mcf	$654,000	Design	Dec., 1953		Dresser	Dresser
*Warren Petroleum	Lindsay, Okla.	Nat. Gaso. Plt.			Design	1954			
*Warren Petroleum	Maysville, Okla.	Nat. Gaso. Plt.			Design	1954			
*Warren Petroleum	Maysville, Okla.	Nat. Gaso. Plt.			Design	1954			
Williston Refining	N. Dakota	Complete Refg.	10,000 bbls.	$5 million	Announced		U.O.P.	Ref. Eng.	Ref. Eng.
Wood River Oil Refining	Calumet, Ill.	Crude Topping, Crk.; Poly.	15,000 bbls 6,800/600 bbls.	$1 million	Design				
SOUTHWEST									
Acadia Corp.	Shreveport, La.	Motor Gas Unit		$2.9 million	Design				
Allied Chemical & Dye	Baton Rouge, La.	Sulfuric Acid Plt.			Under Constr.	End 1953			
Allied Chemical & Dye (Solvay)	Orange, Texas	Petrochemicals Unit		$5 million	Under Constr.	Spring, 1954			
American Cyanamid Company	New Orleans, La.	Petrochem. Plt.		$50 million	Under Constr.	1954		Chemico	Chemico

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licenser	Engineering	Contractor
American Liberty Oil Company	Mt. Pleasant, Texas	T. C. C. Gas Fract. Feed Prep. Gas Con., Poly. Revamp	5,120 bbls.	$2.7 million	Under Constr.	Late 1953	Soc-Vac.	Fluor	Fluor
American Oil Co.	Texas City, Tex.	Cat. Crker.			Under Constr.	1953			
American Petro-Chemical Corp.	Lake Charles, La.	Polyethylene Plt.	$15-20 million		Planned				
Arkansas Fuel Oil Company	Jefferson, Texas	Increased LPG Rec.	31 Mmcf		Under Constr.	1953		Staff	
Aromatics Refining	Baton Rouge, La.	Aromatics Fac.		$11.6 million	Design				
Atlantic Refining Co.	Atreen, Texas	Cat. Reforming	7,500 bbls.		Contracted				Ferguson
H. W. Bass & Sons, Inc.	Live Oak Co., Texas	Nat.Gas.		$3 million	DPA Certified				
J. R. Butler Interests	Howard County, Texas	Natural Gasoline Plt.			Planned				
Carbide & Carbon Chemicals	Texas City, Tex.	Acetylene Plt.			Under Constr.	1953			
Carbide & Carbon Chemicals	Texas City, Tex.	Poly. Resins	140,000 lbs.		Under Constr.	1953			
Carbide & Carbon Chemicals	Seadrift, Texas	Polyethylene & Ethylene Oxide	140,000 lbs.	$43 million	Under Constr.	April, 1954		Brown & Root	Brown & Root
Cities Service	Lake Charles, La.	Fluid Hydro-former	17,250 bbls.	$7 million	Under Constr.	1954		Kellogg	Kellogg
Cities Service Oil	Pampa, Texas	Gasoline Expan.		$222,139	Certified DPA				Parsons
Cities Service Refg.	Lake Charles	Hydro. Feed Prep.	44,450 bbls.	$2 million	Under Constr.	1954		Kellogg	Kellogg
Cities Service Refg.	Lake Charles	Vacuum	26,750 bbls.	$2 million	Under Constr.	1954		Kellogg	Kellogg
Cities Service Oil Co.	Crockett Co., Texas	Nat. Gas		$2.4 million	DPA Certified				
Col-Tex Refining Co.	Colorado City, Texas	Platforming Unit	1,500 bbls.	$933,000	Completing		U.O.P.	Procon	Procon
Columbian Carbon Co.	Seminole, Texas	Sulfur Recovery Unit			Under Constr.	Dec., 1953		Parsons	Parsons
Commercial Solvents Corp.	Sterlington, La.	Ammonium Nitrate Plt.	225 tons		Completing				Ford, Bacon & Davis
		Ammonia	200 tons		Completing				Ford, Bacon & Davis
		Methanol	9,250 bbls.		Completing				Ford, Bacon & Davis
Consolidated Chemical Industries, Inc.	Baytown, Texas	Acid Unit	600 tons		Under Constr.	End 1953			
*Continental Oil Company	Lake Charles, La.	Nat. Gaso. Plt. Expansion	90 Mmcf	$1,500,000	Planned			Hudson	Hudson
Cosden Petroleum	Big Spring, Tex.	Avia.-Gaso. Facl.	2,650 bbls.	$2,920,000	Under Constr.	June, 1954	U.O.P.	U.O.P., Treco	Treco
Crown Central Pet.	Houston, Texas	Crude Topping	2,350 bbls.	$265,000	Design				
Crown Central	Houston	Cat. Cracker	2,400 bbls.						
Crown Central Pet. Company	Pasadena, Texas	Addition to Ref.		$545,863	DPA Certified				
Danaho Ref. Co.	Pettus, Texas	Cat. Crker, Cat. Poly, Expan.	3,500 bbls. 9,500 bbls.			Aug., 1954 1954			
Delta Chemical Co.	Buras, La.	Petrochemical Plt.	70 tons		Planned				
Diamond Alkali	Houston, Texas	Petrochemicals		$2 million	Completed				Brown & Root
Dow Chemical Co.	Freeport, Texas	Ethylene Dibromide		$8.5 million	DPA Certified				
Dow Chemical	Texas City, Tex.	Research Fac.		$2.6 million	Under Constr.	1953			Southwestern
Dow Chemical	Freeport, Texas.	Styrene Plastics		$1.6 million	Under Constr.			Braun	Braun
Dow Chemical	Freeport, Texas	Benzene Addi.		$1.2 million	Certified DPA				
Dow Chemical Co.	Freeport, Texas	Ethyl-Dow Plt.			Under Constr.	1953	Staff	Staff	Tellepsen
Du Pont	Beaumont, Tex.	Methionine Plt.		$4,000,000	Planning				
Eastern States Pet.	Houston, Texas	Ethylene Mfg.		$4 million	Projected			U.O.P.	
Eastern States Pet.	Houston, Texas	Rehab. Closed Plt.			Army Contract				
Eastman Kodak Co.	Longview, Tex.	Polyethylene Plt.	20,000,000 lbs./yr.		Projected				
Esso Standard	Baton Rouge	Aromatics Fac.			Under Constr.	2nd Qtr., 1954			Staff
Esso Standard	Baton Rouge	Crude Distill.			Under Constr.	2nd Qtr., 1954		S.O.D.	Kellogg
Esso Standard	Baton Rouge	Cat. Cracker	31,000 bbls.		Under Constr.	2nd Qtr., 1954		S.O.D.	Kellogg
Esso Standard	Baton Rouge	Fuel Products Expansion	60,000 bbls.		Under Constr.	2nd Qtr., 1954		S.O.D., Kellogg, Ref. Eng.	Kellogg
Esso Standard	Baton Rouge,La.	Pressed Oil Dist. Unit	5,540 bbls.		Announced	2nd Qtr., 1954		S.O.D., Parsons	Parsons
D. D. Feldman Co.	Lake Arthur, La.	Petrochem. Plt.		$843,000	Applied for certificate of necessity				
Foster-Grant Co.	Baton Rouge, La.	Styrene Monomer Plt.						Foster-Grant	
Gilmore Refineries	Odessa, Texas	New Refinery	50,000 bbls.	$40 million	Design				Ford-Bacon-Davis
Goliad Corp.	Lavaca Co., Tex.	Propane, Isobutane Nat. Gasoline		$2.7 million	DPA Certified				
Great Southern Chemical Corp.	Corpus Christi, Texas	Platforming and Udex Units	4,000 bbls.	$5,000,000	Completed		U.O.P.	U.O.P.,Procon, Fluor	Procon, Fluor
Gulf Oil	Pt. Arthur, Tex.	Exp. Ethylene Fac.			Out for Bids				
Gulf Oil	Port Arthur	Sulfuric Acid	300 tons	$2,318,855	Completing			Leonard Constr.	Leonard Constr.
Heyden Chemical & Monsanto Chemical	Texas City, Tex.	Methanol Plt.	1,600 bbls.	$8,000,000	Projected	Jan., 1955			
Humble O&R Co.	Baytown, Texas	Cat. Light Ends Recov. Unit	37 Mmcf. Wet Gas	$4.5 million	Under Constr.	Jan., 1954		Fluor	Fluor
Humble O&R Co.	Baytown, Texas	Propane Deasphalting Unit	28,000 bbls.	$5.9 million	Under Constr.	March, 1954		Kellogg	Kellogg
Humble O&R Co.	Baytown, Texas	Cat. Poly.	4500 bbls.	$5,300,000	Under Constr.	May, 1954	Hydrocarbon	Hydrocarbon	Hydrocarbon
*Humble O&R Co.	Baytown, Texas	Pipe Still (crude)	75,000 bbls.	$6,500,000	Under Constr.	May, 1954		Foster Wheeler	Foster Wheeler
Humble & Consolidated Chemical Industries, Inc.	Baytown, Texas	Sulfuric Acid			Planning				
Ingram Products	Mereaux, La.	Refinery Modernization	7,000 bbls.		Under Constr.	Early, 1954	U.O.P.	U.O.P.	Procon
Jergins Oil Co. of Texas	Dewitt, Texas	Comp. Stripper Plt.			Authorized				
Kerr-McGee Oil	Moore Co., Tex.	Natural Gaso.	55 Mmcf	$850,000	Under Constr.	1953		Dresser, Staff	Dresser
Kolker Chemical Works, Inc.	Houston	Lindane		$1 million	Planning				
Levelland Refining	Amarillo, Texas	Cat. Crk.; Poly.	3,000/150 bbls.	$2.4 million	Design				
Lion Oil Co.	Luling, La.	Chemical Plts.	1,280 tons	$31 million	Under Constr.	Early, 1954		Chemico	Lummus
Magnolia	Hurricane Creek Field, Beauregard Parish, La.	Casinghead Gasoline Plt.			Completed				
Magnolia Petroleum	Beaumont, Tex.	Therm. Cat. Reforming	17,000 bbls.	$10 million	Under Constr.	Late, 1954	Soc.-Vac.		Lummus
Magnolia Petroleum	Chaison, Texas	Cooling Facil.			Completing			Fluor	Fluor

Table Continued on Page 197

The Lady was for burning

In rural Indo-China, a farmer once offered a traveler his prettiest daughter in exchange for a reading lamp and a drum of kerosene.

This happened, not fifty years ago, but within the last decade.

It is hard for Americans to imagine what life is like in the "have-not" nations of the world. Some communities in Honduras have never seen petroleum, nor any product thereof. In Western Africa it is not unusual to find one lamp in a tribal group of 15,000 people.

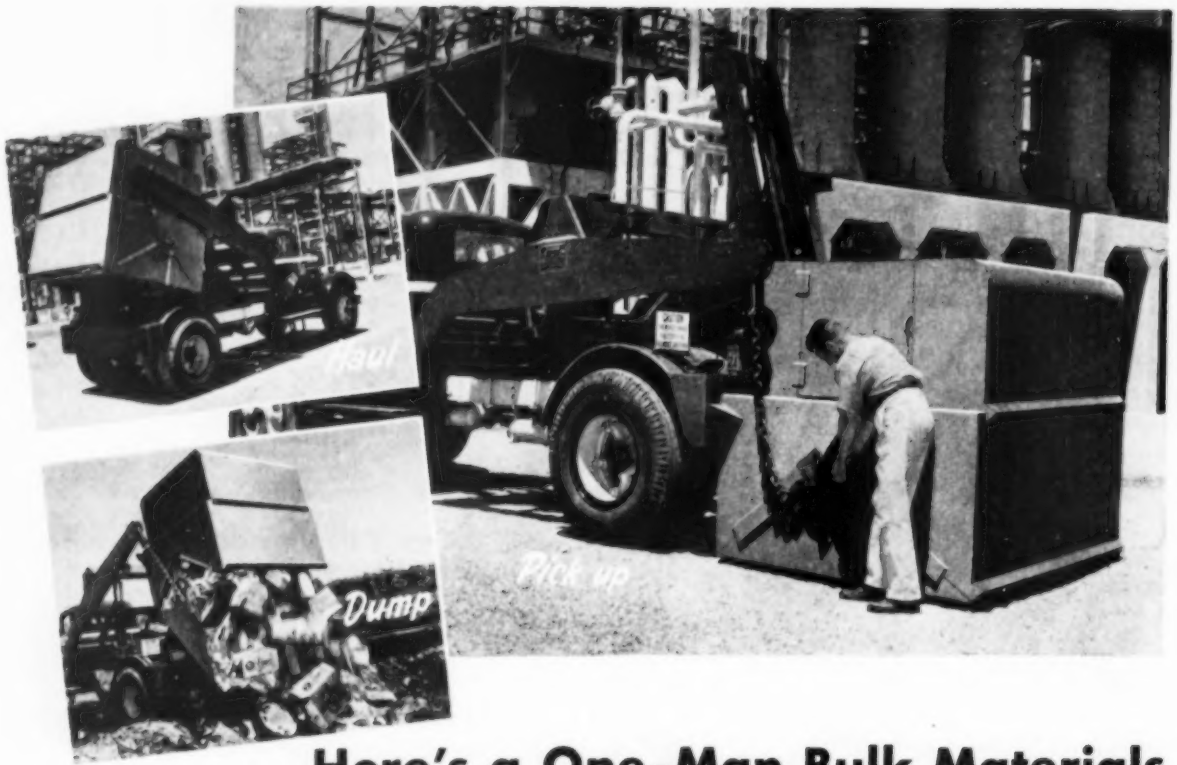
The fact that a country has no petroleum resources of its own is not always the reason for oil poverty. Many so-called "have-nots" live in land where oil could be found. What they really "have not" is the initiative to look for it!

The oil companies of America have a super-abundance of that great natural resource—Initiative. It is essential to their success. They cannot afford to discourage easily, for the odds are ten to one against a wildcat becoming a producer.

In spite of these odds, Cities Service has discovered some of America's historic oil fields. In the last five years, its geologists have added millions of barrels of much-needed oil to our national reserves. Because of these men, and others like them throughout the industry, we can be sure our country will never be one of the petroleum have-nots of the world.

CITIES SERVICE

Quality Petroleum Products



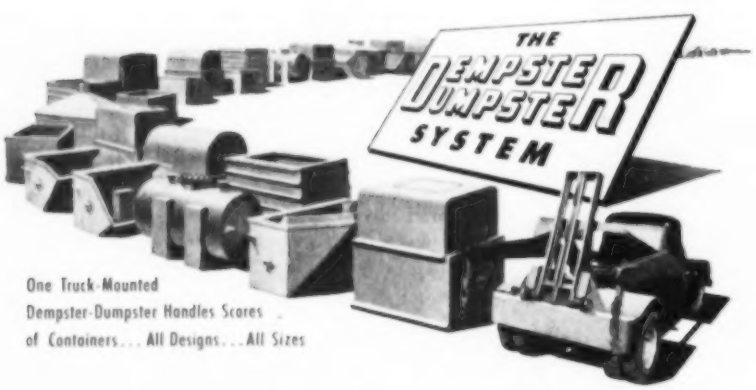
Here's a One-Man Bulk Materials Handling System for Your Plant...

In the Dempster-Dumpster System of bulk materials handling only one man, the driver of the truck-mounted Dempster-Dumpster, is required for operation. The Dempster-Dumpster serves scores of detachable Dempster-Dumpster Containers. Container capacities range up to 4 times that of conventional dump truck bodies and each container is designed to suit the materials to be handled—be they solids, liquids or dust . . . hot or cold . . . bulky, light or heavy. You simply place these containers at convenient materials accumulation points inside or outside buildings. When loaded each container is picked up, hauled and emptied (as shown above) or load set down intact. Entire operation is handled by hydraulic controls in cab.

Containers shown below are just a few of the many available or that can be built to meet your needs. They enable you to handle, at tremendous savings, materials of many descriptions—trash and waste materials, raw materials, finished products, etc. —with only one truck and only one man, the driver.

Without question, the Dempster-Dumpster System is the most economical and most efficient method of plant materials handling by truck ever devised!

Write to us for complete information. Manufactured exclusively by Dempster Brothers, Inc.



One Truck-Mounted
Dempster-Dumpster Handles Scores
of Containers... All Designs... All Sizes

DEMPSTER BROTHERS, 5103 Dempster Bldg., Knoxville 17, Tennessee

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Magnolia Petroleum	Midland Co., Texas	Nat. Gas & Butane	.....	$8.3 million	Completed	.....	.....	.....	.....
Mayfair Minerals	McAllen, Texas	Natural Gas Plt.	.....	.....	Announced	.....	.....	.....	.....
McMurrey Refining	Tyler, Texas	HF Alkylation	1,400 bbls.	.....	Under Constr.	End, 1953	.....	.....	.....
McMurrey Refg. Co.	Tyler, Texas	Pet. Refining	.....	$70,000	DPA Certified	.....	.....	.....	.....
McMurrey Refining	Tyler, Texas	Platforming Unit	5,000 bbls.	.....	Under Constr.	End, 1953	U.O.P.	U.O.P.	Procon
McMurrey Refining	Tyler, Texas	Crude Unit	12,500 bbls.	.....	Completing	.....	.....	.....	.....
		Decarbonizing Unit	8,000 bbls.	.....	Completing	.....	.....	Blaw-Knox	Blaw-Knox
Monsanto	Texas City, Tex.	Vinyl Chloride	.....	$7.3 million	Announced	.....	.....	.....	.....
Monsanto Chemical	Site not Finalized	Polyethylene Plt.	66,000,000 lbs./yr.	.....	.....	.....	.....	.....	.....
Natural Gasoline Co.	Hawkins, Texas	Plt. Expan.	10 Mmcf	.....	Completing	.....	.....	Gas Plt. Constr.	Gas Plt. Constr.
Onyx Refining Co.	Abilene, Texas	Platformer	650 bbls.	.....	Completing	.....	U.O.P.	U.O.P.	Staff
		Expansion	†500 bbls.	.....	Planned	.....	.....	.....	.....
Pan American Refining	Texas City, Tex.	Alky. Expan.	.....	$2,800,000	Completing	.....	.....	McKee	McKee
Pan American Refining	Texas City	Refinery Expan.	3,000 bbls.	.....	Completing	.....	.....	McKee	McKee
Pan American Refining	Texas City, Tex.	Fluid Cat. Cracking	30,000 bbls.	$13,000,000	Completing	.....	.....	Lummus	Lummus
Pan American Refining	Texas City	Poly. Unit	†2,400 bbls.	.....	Completing	.....	.....	Lummus	Lummus
Pecos Petroleum	Pecos, Texas	Aromatics Expansion	240/260 bbls.	.....	Planned	.....	.....	.....	.....
Petrolite Corp.	Sweeney, Texas	Pet. Ref.	.....	$25,899	DPA Certified	.....	.....	.....	.....
Petrolite	Destrehan, La.	Pet. Ref.	.....	$60,000	DPA Certified	.....	.....	.....	.....
Phillips Chemical	Houston, Texas	Ammonia Plt.	450 tons	.....	Under Constr.	Late, 1953	.....	Chemico	Hydrocarbon Constr.
Phillips Chemical	Houston, Texas	Add to Ammonium Sulfate Plt.	250 tons	.....	Under Constr.	Late, 1953	.....	Phillips Chem.	Rust
Phillips Chemical Co.	Borger, Texas	Carbon Black	36,000 lbs.	.....	Under Constr.	End, 1953	.....	Phillips	Bowman-Chase
Phillips Chem. Co.	Houston, Texas	Phosphate	405 tons	.....	Under Constr.	Dec., 1953	.....	Rust	Rust
Phillips Chem.	Etter, Texas	Increase Cap. of Nitric Acid	135 tons	.....	Under Constr.	Late, 1953	.....	C. & I.	Ch. Pro.
Phillips Pet.	Borger, Texas	Alky. Expan.	.....	$15.5 million	Complete	.....	.....	Phillips	Phillips
Phillips Pet. Co.	Upton Co., Tex.	Natural Gasoline Plt.	60,000 cf.	.....	Complete	.....	.....	Phillips	Phillips
*Phillips Pet. Co.	Sweeny, Texas	UOP Platformer	16,000 bbls.	.....	Constr. to begin 1954	Late 1954	U.O.P.	Procon	Procon
Pontiac Refining	Corpus Christi	Av-Gas Expan.	.....	$2 million	PAD Certified	.....	.....	.....	.....
Premier Petroleum	Ft. Worth, Tex.	Refinery Expan.	.....	$3.6 million	DPA Certified	.....	.....	.....	.....
Premier Petroleum	Ft. Worth, Tex.	Cat. Crker.	2,600 bbls.	$2,000,000	Under Constr.	Mid, 1954	U.O.P.	U.O.P.	Ref. Eng.
Premier Pet. Co.	Longview, Tex.	Cat. Poly. Plt.	.....	.....	Under Constr.	.....	.....	.....	.....
Pure Oil	Smiths Bluff	Basic Refining	.....	$10.8 million	Announced	1953	.....	.....	.....
Pure Oil	Smiths Bluff	Cat. Poly.	.....	.....	Under Constr.	1953	.....	Kellogg	Kellogg
Pure Oil	Smiths Bluff	Expan. Alkyl.	1,900 bbls.	$390,000	Under Constr.	1953	.....	Kellogg	Kellogg
Pure Oil	Smiths Bluff	Orthoflow Crk.	15,000 bbls.	.....	Under Constr.	1953	.....	Kellogg	Kellogg
Pure Oil	Smiths Bluff, Texas	Feed Prep-Vac Flash	20,000 bbls.	.....	Under Constr.	.....	.....	Kellogg	Kellogg
Runnels Gas Products Corp.	Runnels Co., Texas	Gaso. & Prem. Maint. Plt.	20 Mmcf.	$3 million	Planning	.....	.....	.....	.....
Shamrock Oil & Gas Corp.	McKee, Texas	Gaso. Ref. Treater	.....	$80,000	Planning	.....	.....	.....	.....
Shell Chemical Corp	Houston	Ethylene Plt., Alt.	.....	$629,000	Completing	.....	.....	Fluor	Fluor
*Shell Chemical Co.	Norco, La.	Glycerine Plt.	25 million lbs./yr.	.....	Planning	.....	.....	.....	.....
Shell Oil Co.	Deer Park, Tex.	Pet. Ref.	.....	$300,000	DPA Certified	.....	.....	.....	.....
Shell Oil	Norco, La.	Expansion	†25,000 bpd.	$41 million	Under Constr.	3rd Qtr., 1954	.....	.....	Pritchard, Foster Wheeler, McKee
Shell Oil	Houston, Texas	Av-Gas Components	.....	$1 million	Certified DPA	.....	.....	.....	.....
Sinclair Refining	Houston, Texas	Expan.: Cat. Crker, Crude Still, Vacuum Unit, Trting Boiler	25,000 bbls.	$33,000,000	Completing	.....	.....	.....	Braun, Fluor, White
Southern Production Co.	Pledger Field, Texas	Gaso. Extr. Plt.	190 Mmcf	$4,844,000	Under Constr.	Dec., 1953	.....	.....	Stearns-Roger
South Texas Corp.	Nueces Co., Tex.	Expanded Products Mfg.	.....	.....	Announced	.....	.....	.....	.....
Spencer Chemical	Orange, Texas	Polyethylene Plt.	45,000,000 lbs./yr.	$15,000,000	Design	Spring, 1955	I.C.I. of England	Staff	Quaker Valley Constr.
Stanolind Oil	Superior, La.	Hydroforming	.....	.....	Considered	1953	.....	.....	.....
Stanolind O&G	Pettus, Texas	Sales Gas Fac.	12.5 Mmcf	.....	Engineering	1st Qtr., 1954	.....	Staff	.....
Stanolind O&G	Oakville, Texas	Gas Injection	25 Mmcf	.....	Considered	1st Qtr., 1954	.....	Staff	.....
*Sunray Oil Co.	Snyder, Texas	Gaso. Plt. Ext.	.....	$1,500,000	Engineering	2nd Qtr., 1954	.....	Fluor	Fluor
Suntide Ref. Co.	Corpus Christi	Crude Oil Ref.	30,000 bbls.	$15 million	Under Constr.	Nov., 1953	Lummus	Lummus	Lummus
*Suntide Refining	Corpus Christi, Texas	Increase Alkylation Fac.	.....	.....	Planned	.....	.....	.....	.....
		Double Crude Capacity	50,000 bbls.	$11,400,000	ODM Approved	.....	.....	.....	.....
Taylor Oil & Gas Company	Corpus Christi, Texas	Platform. Unit	5,000 bbls.	.....	Completed	.....	U.O.P.	U.O.P.	Staff
*Texas Eastman Co.	Longview, Texas	Syn. Hard Wax Plt.	.....	$7,000,000	Under Constr.	.....	.....	.....	.....
Texas Eastman	Longview, Tex.	Petrochemicals	20,000 bbls. Propane	$5.7 million	Partial Oper.	.....	.....	.....	.....
The Texas Co.	Port Arthur, Texas	Catalytic Reformer	20,000 bbls.	$1,300,000	Under Constr.	2nd Qtr., 1954	.....	U.O.P. & Others	Procon & Others
The Texas Co.	Amarillo, Texas	Expan. & Mod. Cat. Cracker Atmos. Crude Pipe Still, Delayed Coker, Alky. Unit, Cat. Poly., Treating & LPG Handling Fac.	†7,500 bbls.	$20,500,000	Under Constr.	End, 1954	.....	Kellogg, U.O.P.	Kellogg & Others
The Texas Co.	El Paso, Texas	Expan. & Mod. Atmos. Crude Pipe Still, Cat. Cracker, Delayed Coker, Cat. Poly., Treating & LPG Handling Fac.	†5,400 bbls.	.....	Under Constr.	End, 1954	.....	Foster Wheeler, U.O.P.	Foster Wheeler & Others

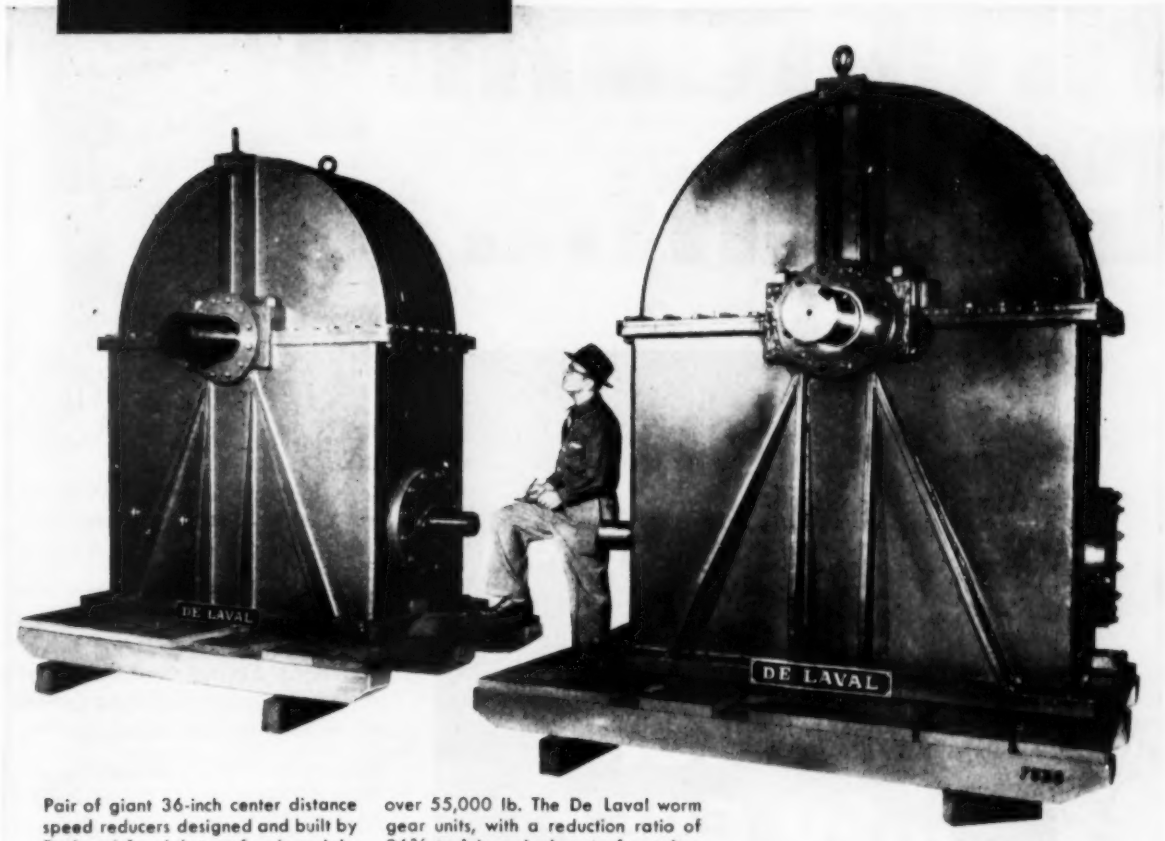
REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
The Texas Co.	Paradis, La.	Gasc. Plt.	115 Mmcf		Under Constr.	Nov., 1953			O. L. Olsen
The Texas Co.	Port Arthur, Texas	Addition Cracked Naphtha Stabilization Fac.	25,000 bbls.		Under Constr.	4th Qtr., 1953		The Texas Co.	Caruth-Dishman & Others
Texas Gas Products Corporation	Rankin, Texas	Gas Plt. Expan.			Completing			Texas Natural	Texas Natural
Texas Gas Products Corp.	Upton, Midland, Regan and Glasscock Co., Texas	Nat. Gas			Completing				
United Carbon Co.	Shamrock, Texas	Carbon Black	68,500 lbs.	$1.5 million	Under Constr.				
United Gas Pipe Line	Sterlington, La.	Dehydration	125,000 mcf		Completed				Staff
Universal Oil Products	Mooringsport, La.	Synthetic Cat. Mfg.			Announced				
Wickett Refining	Wickett, Texas	Thermal Crker	2,000 bbls.		Under Constr.				
ROCKY MOUNTAIN									
Allied Chemical & Dye Corp.	La Platte, Nebr.	Fertilizer			Under Constr.	May, 1954		Girdler	Catalytic Constr.
Atlantic Refining Co.	Lovington, N.M.	Natural Gas	25 Mmcf		Projected				
Continental Sulphur & Phosphate Corp.	Thermopolis, Wyoming	Sulfur Extraction			Planning				Chemico
Empire Pet. Co.	Denver, Colo.	Crude Expan.	5,000 bbls.	$180,000	Complete			Koch	Staff
Frontier Refining	Cheyenne, Wyo.	Plt. Addition	6,500 bbls.	$717,000	Completing		U.O.P.	U.O.P.	C. E. Wilson Constr.
		LPG Addition		$150,000	Completing		U.O.P.	U.O.P.	Staff
Garfield Chemical & Mfg. Corp.	Salt Lake City	Sulfuric Acid		$2.5 million	Plan				
General Pet. Corp.	Worland, Wyo.	Gasoline Ext. & Sulfur Recov.	8 Mmcf	$4 million	Under Constr.			Fluor	
Husky Oil Co.	Cody, Wyoming	Reformer	1,000 bbls.	$350,000	Completed		Atlantic	Grebe & Doremus	Grebe & Doremus
Husky Oil	Cody, Wyo.	Gas-Oil Desulfurizer	600 bbls.	$300,000	Completed			Grebe & Doremus	Grebe & Doremus
Husky Oil	Cody, Wyo.	Vacuum Unit	6,000 bbls.	$350,000	Under Constr.	Nov., 1953		Koch	Staff
Imperial Sulphur & Acid Co.	Farmington, N. Mex.	Sulfur Plt.			Completed				
Malco Ref.	Prewitt, N. M.	Pet. Ref.		$239,500	Completed				
Malco Refineries	Bloomfield, N.M.	Refinery			Completed				
Malco Refineries	Artesia, N. M.	Expansion	12,000 bbls.		Completed				
McNutt Oil & Ref. Company	Brickland, N.M.	Platformer	600 bbls.	$300,000	Completed		U.O.P.	U.O.P.-Procon	Staff
Oriental Refining Co.	Denver, Colo.	Perco Cyclover-sion Unit	1,500 bbls.		Under Constr.				
Phillips Chem.	Eunice, N.M.	Sulfur Extrac.	100 tons	$1.5 million	Contracted				
Phillips Petroleum	Lea City, N.M.	Natural Gasoline		$27,150	PAD Certified				
Phillips Petroleum	Great Falls, Montana	Refining		$3 million	Certified DPA				
Phillips Petroleum Co.	Woods Cross, Utah	Expansion			Projected				
Proven Oil & Refining	Florence, Ariz.	Refinery	15,000 bbls.	$18.3 million	Under Constr.	1955		Ebasco and Lummus	
*Skelly Oil Co.	Eunice, N.M.	Plt. Expansion	120 Mmcf		Design			Skelly	J. E. Carlson
Socony-Vacuum Oil Co.	Manderson, Wyo.	Nat. Gas Plt.		$15,000,000	Projected				
Standard Oil (Ind.)	Casper, Wyo.	Alkylation Unit	575 bbls.		Design	Mid 1954			
Sullivan Mining Co.	Kellogg, Idaho	Sulfuric Acid Plt.	300 tons		Under Constr.	January, 1954		S & B	S & B
*Sure-Seal Corp.	Salt Lake City	Wax Refinery		$2,000,000	Under Constr.				
Utah Chemical Co.	Sanpete Valley, Utah	Ammonia Plt.	278 tons	$18,800,000	Planned				Cat. Constr.
Utah Oil Ref.	Salt Lake City	Expansion		$1 million	Under Constr.	1953		Staff	CB&I
Warren Pet. Corp.	Monument, N.M.	Expansion	123 Mmcf.		Under Constr.	1953		Staff	Dresser
Warren Petroleum	Lea Co., N.M.	Nat Gaso. Plt.	22 Mmcf.		Under Constr.	Feb., 1954		Fluor	Fluor
Western States Refg.	Salt Lake City	Topping; Crker.	3,000/2,200 bbls.	$1.1 million					
WEST COAST									
Amoniaco Corp.	Brea, Calif.	Ammonia Plt.		$13,000,000	Under Constr.	Summer, 1954		Braun	Braun
Caminol Co.	Hanford, Calif.	Motor Gasoline & Distillate			Announced	1953			
Carbide & Carbon Chemicals Company	Torrance, Calif.	Polyethylene Plt.	60 million lbs./yr.	$36 million	Under Constr.	End, 1954			
*Douglas Oil Co.	Bakersfield, Calif.	Cat. Reforming Unit	2,500 bbls.	$500,000	Planned	Mar., 1954	Atlantic		Parsons
Dow Chemical Co.	Torrance, Calif.	Styron Mfg. Plt.			Completing				Bechtel
Envoy Pet.	Long Beach, Calif.	Asphalt Fac.	700 bbls.						
Eureka Refining	Long Beach, Cal.	Cat. Crker.	6,000 bbls.	$2.2 million					
Filtrol Corp.	Vernon, Calif.	Ammonium Sulfate	150 tons	$5,000,000	Under Constr.	Jan., 1954		J. H. Pomeroy	
General Petroleum	Torrance, Calif.	Therm. Cat. Reform.	19,000 bbls.	$9 million	Projected	Fall, 1954		Soc-Vac., Bechtel	Bechtel
General Pet. Corp.	Ferndale, Wash.	Refinery	35,000 bbls.	$35 million	Under Constr.	August, 1954		Bechtel	Bechtel
General Petroleum	Vernon, Calif.	Naphthenic Acid Vac. still		$210,000	Completing			E&A	E&A
General Petroleum	Torrance, Calif.	Depropanizer		$350,000	Engineering	Fall, 1954		E&A	E&A
*Hancock Oil Co.	Long Beach, Calif.	Cat. Crker. & Facilities	4,200 bbls.	$3,500,000	PAD Certified				
International Mineral and Chemical	San Jose, Calif.	Chemical Process Plt.		$425,000	Completed				Bechtel
Mohawk Petroleum	Bakersfield, Calif.	Jet Fuel Prod.		$3 million	Announced				
Monsanto Chemical Company	Avon, Calif.	Phenol			Under Constr.	Early, 1954			United Engrs. & Constructors
Navy	San Joaquin, Calif.	Natural Gas Plt.	50,000 mcf	$5 million	Completed				Parsons-Macco
Pacific Oil & Refining Co.	Puget Sound, Wash.	Refinery	10,000 bbls.		Projected				
Richfield Oil	Watson, Calif.	Expansion; Cat. Cracker; Aromatics	20,000 bbls.	$43 million	Under Constr.	1954		Braun	Fluor
Richfield Oil	Los Angeles	Ref. Expan.	120,000 bbls.	$40 million	Under Constr.	Aug., 1954			Fluor
Rothschild Oil	Santa Fe Springs, Calif.	Cat. Cracker	6,000 bbls.	$2 million					Braun
Shell Chemical	Ventura, Calif.	Synthetic Ammonia Plt.	150 tons.		Completing			Kellogg	Kellogg, Gibbs & Hill
Shell Oil Co.	Wilmington, Calif.	Distillation Tower	50,000 bbls.	$7 million	Under Constr.	Late 1953		Bechtel	Bechtel

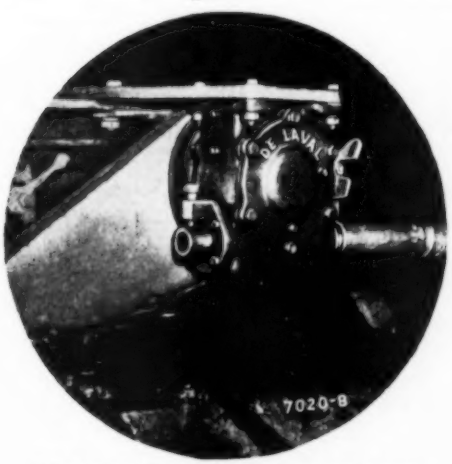
Table Continued on Page 201

DE LAVAL
SPEED REDUCERS

from dwarf to giant size



Pair of giant 36-inch center distance speed reducers designed and built by De Laval for slab transfers in a slab-bing-blooming mill. These slab transfers are used to convey steel slabs up to 12 in. thick and 42 in. wide, weighing over 55,000 lb. The De Laval worm gear units, with a reduction ratio of 26⅔ to 1 in a single set of gearing, are each driven by a 200 hp, 410 rpm motor coupled directly to the input shafts of the slab transfers.



Here's one of the smaller De Laval worm gear speed reducers with a 3″ center distance being used for a new coal drilling machine.

De Laval heavy-duty worm gear speed reducers seldom require attention under the most rugged operating conditions. They make a quiet, close-couple compact drive. They permit high ratio reductions in a minimum of space and withstand severe shock loads without damage. De Laval builds all sizes from 3″ to 36″ center distances for transmission ratios of 3.1:1 to 100:1 in single reduction units and ratios of 50:1 to 8000:1 in double reduction units. Whether you need dwarf or giant worm gearing, consult De Laval for engineering assistance. *Send for De Laval Manuals G-WBV and G-WWH containing data on single and double reduction units.*

DE LAVAL *Speed Reducers*

DE LAVAL STEAM TURBINE COMPANY

811 Nottingham Way, Trenton 2, New Jersey DL-210

EAGLE-PICHER

Fireproofing Cement...

Never before a fireproofing system

SO LIGHT IN WEIGHT ...SO EASY TO APPLY

Eagle-Picher's Fireproofing Cement provides the *lightest, easiest-to-apply* fireproofing system you can get.

Light weight means simpler, less costly construction. On average jobs, there is no need for heavy reinforcing. For tall steel structures, this weight saving may even permit use of smaller steel columns.

Easy application saves time, money. You simply trowel on Eagle-Picher Fireproofing Cement after surfaces have been prepared by installation of metal lath or mesh. Takes only 24 hours to set HARD.

Highly effective, Eagle-Picher Fireproofing Cement serves in temperatures up to 2000 F. Underwriters' Laboratories give it a rating of C-3 (three hours) when applied to metal lath as a coating $1\frac{3}{4}$ inches thick.

RESISTS CORROSION. *Patented rust inhibitors are incorporated in Eagle-Picher Fireproofing Cement, thus affording valuable plus protection against rust and corrosion where the material contacts structural members.*

Since 1843

EAGLE EP PICHER

THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

For greater efficiency, protection and economy, specify these Eagle-Picher products:
Insulating Felts • Insulating Block • Blankets • Loose Wool • Mineral Wool Pipe Covering • Stalastic Stamastic • Insulseal • Finishing Cements • Insulating Cements • Swetchek • Insul-Stic • Fireproofing Cement

Member of Industrial Mineral Fiber Institute

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Shell Oil Co.	Ventura, Calif.	Nat. Gaso. Plt. Revisions & Extensions		$1,000,000	Completing				Fluor
*Shell Oil	Anacortes, Wash.	Refinery	50,000 bbls.	$75,000,000	Constr. to start Mid 1954	End, 1955			Bechtel
Shell Oil	Martinez, Calif.	Platform. Unit	4,500 bbls.	$1,700,000	Under Constr.	June, 1954	U.O.P.	U.O.P.	
Signal Oil & Gas	Los Angeles, Calif.	Butanes-Iso-butane		$500,000					
Standard (Calif.)	Richmond, Calif.	SynthetiePhenol	35 miln. lbs./yr.	$4 million	Under Constr.	January, 1954		Standard	Stone & Webster
*Standard (Calif.)	Richmond, Calif.	Cat. Reformer		$20,000,000	Planning	July, 1955			
	El Segundo, Calif.	Cat. Reformer							
Standard (Calif.)	El Segundo, Calif.	Paraxylene Plt.			Completed				Fluor
Standard (Calif.)	El Segundo, Calif.	Offsite Fac.			Engineering	4th Qtr., 1954		Fluor	Fluor
Standard Oil (Calif.)	El Segundo	Cat. Crker	36,000 bbls.	$15,000,000	Under Constr.	Sept., 1954		Fluor	Fluor
Standard (Calif.)	El Segundo, Calif.	Residuum Strper	52,000 bbls.	$3,000,000	Under Constr.	March, 1954		Kellogg	Kellogg
Stauffer Chemical	Compton, Calif.	Sulfuric Acid		$57,070	Engineering				
Stauffer Chemical	Richmond, Calif.	Sulfuric Acid		$283,500					
Sunset Oil Co.	Torrance, Calif.	Expansion		$1,000,000	Planned			Clark & Gesselin	
Union Oil (Calif.)	Los, Angeles	Revisions of Tankage & Oil Transfer Sys.		$4,000,000	Completed			Fluor	Fluor
Union Oil (Calif.)	Los Angeles	Facilities to Reduce Hydro-carbon Losses		$515,000	Completing			E & A	Buckner
*Union Oil (Calif.)	Willbridge, Ore.	Lub. Oil Blending Plt.		$450,000	Engineering	2nd Qtr., 1954		Staff, Sweco	
*Union Oil (Calif.)	Santa Maria, Calif.	Coking Plt.			Projected				
*Union Oil (Calif.)	Cut Bank, Mont.	Cat. Reform.	600 bbls.		Engineering	Sept., 1954			Parsons
FOREIGN									
Canada									
British American Oil Company	Clarkson, Ontario	Ref. Additions & Fld. Cat. Crker.	8,300 bbls.	$8 million	Planning	May, 1954	Kellogg	Canadian Kellogg & Barnes	Canadian Kellogg & Barnes
British American Oil Co.	Montreal	Cumene Plt.	600 bbls.	$800,000	Under Constr.	Dec., 1954	U.O.P.	U.O.P. & Staff	Barnes
Compagnie Financiere Belge Des Petroles (Petrofina)	Quebec, Canada	Refinery			Planned				
Campbell Absorption Plant, Ltd.	Alberta, Canada	Natural Gaso. Plt.			Planned				
Canadian Chemical Company	Edmonton Area, Alberta	Petro Chemical Plt.		$50 million	Under Constr.	1953		Celanese-Brown & Root	Brown & Root
Canadian Industries, Ltd.	Edmonton, Alta.	Polythene Plt.		$13,000,000	Under Constr.	Late 1953	Imp. Chem. Ind.	Lummus, Staff	Poole Constr.
Canadian Industries, Ltd.	Maitland, Ontario	Petrochem. Plt.				End, 1953			
Canada Southern Oils	Saskatchewan	Refinery	10-20,000 bbls.	$7,000,000-$10,000,000					
Consumer's Co-Op. Ref.	Regina, Saskatchewan	Mod. & Expan. Cat. Crker, Poly Gas & Vac. Units	11,000 bbls.	$5,500,000 $8,000,000	Under Constr.	April, 1954	U.O.P.	U.O.P.	Ref. Eng.
Hi-Way Refineries, Ltd.	Saskatoon, Canada	Cat. Crker Crude Revamp	3,000 bbls. 3,500 bbls.	$2.5 million	Under Constr.	Early, 1954	U.O.P.	Ref. Eng.	Ref. Eng.
Hooker Chemicals, Ltd.	N. Vancouver, B. C.	Chemicals			Projected				
Imperial Chemical Industries of Canada	Milhaven, Ont.	Terylene Fibre	11,000,000 lbs./yr.	$20,000,000	Under Constr.	Mid 1955		Ferguson	Ferguson
Imperial Oil	Sarnia, Ontario	Quality Control Lab. Packaging & Shipping Plt and Mech. Shops		$6,000,000	Planned	1954			
Imperial Oil	Edmonton, Alberta	Lube Oil Plt.	2,000 bbls.	$10,000,000	Planned Planned	Mid 1955			
Imperial Oil	Regina, Sask.	Mod & Expan.	†2,500 bbls.	$7 million	Under Constr.	Early 1954		Staff	
Imperial Oil, Ltd	Montreal, Quebec	25% Cap. Increase	†12,000 bbls.	$10,000,000	Planned	Early, 1954			
Imperial Oil, Ltd	Winnipeg, Manitoba	Cat. Poly. Plt.	250 bbls.	$750,000	Planned	May, 1954		Staff	
Kamloops Refinery Syn.	Kamloops, British Columbia	Topping Unit, TCC Cat. Crk., Cat. Poly., Gas Recovery	2,500 bbls.	$3 million	Projected	1954		Barnes	Barnes
*Kendall Ref. of Canada	Toronto, Canada	Lub. Oil Compounding, packaging & Distrib. Plt.			Considering				
Leduc Southern Absorption, Ltd.	Edmonton, Canada	Gas Absorption Plt.		$20,000,000	Permit Granted				
Lubrizol of Canada, Ltd.	Niagara Falls, Ontario	Lube Oil Addi.			Under Constr.	End, 1953			
Midland Pet. & Pacific Pet.	Stettler, Alta.	Crude Refinery	4,000 bbls.	$2 million	Under Constr.				
Monsanto Canada, Ltd.	Ville La Salle, Canada	Petroleum Addi. Plt.		$400,000	Under Constr.	End, 1953			
North Star Oil, Ltd	St. Boniface, Manitoba	Modernization, Cat. Cracker	8,000 bbls.	$5-6,000,000	Engineering		U.O.P.	U.O.P.	
Panther Oil & Grease Mfg. Co. of Canada, Ltd.	Leaside, Ontario	Mfg. Cold Process Liquid Roof Coating	4,500 gals.		Projected				
		Mfg. Grease	10,000 lbs.		Projected				
		Blending Oils	2,000 gals.		Projected				
Refinery Operators, Ltd.	Kamloops, B.C.	Refinery	5,000 bbls.	$6,000,000	Under Constr.				
Royalite Oil Co.	Kamloops, B.C.	Refinery	5,600 bbls.		Under Constr.	Nov., 1954			
Shell Oil Co. of Canada, Ltd.	Vancouver, B. C.	Refinery Expan.	†15,000 bbls.	$10 million	Engineering	4th Qtr., 1953	U.O.P.	U.O.P.	Fluor
Shell Oil Co. of Canada	Okotoks, Canada	Sulfur Ext. Plt.			Planned				
Sun Oil	Sarnia, Ont.	Refinery	15,000 bbls.	$14,000,000	Completing		Houdry	Cat. Const.-Sun	Cat. Constr.
Supreme Refineries	Ogden, Alta.	Asphalt Plt.			Planning				
Texaco Exploration Co.	Edmonton, Canada	Gas Absorp. Plt.		$20,000,000	Permit Granted				
Wainwright Refineries, Ltd.	Wainwright, Alberta	Dehydrating & Desalt'g Equip.	650 bbls.	$30,000	Planned	1953			Petreco

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

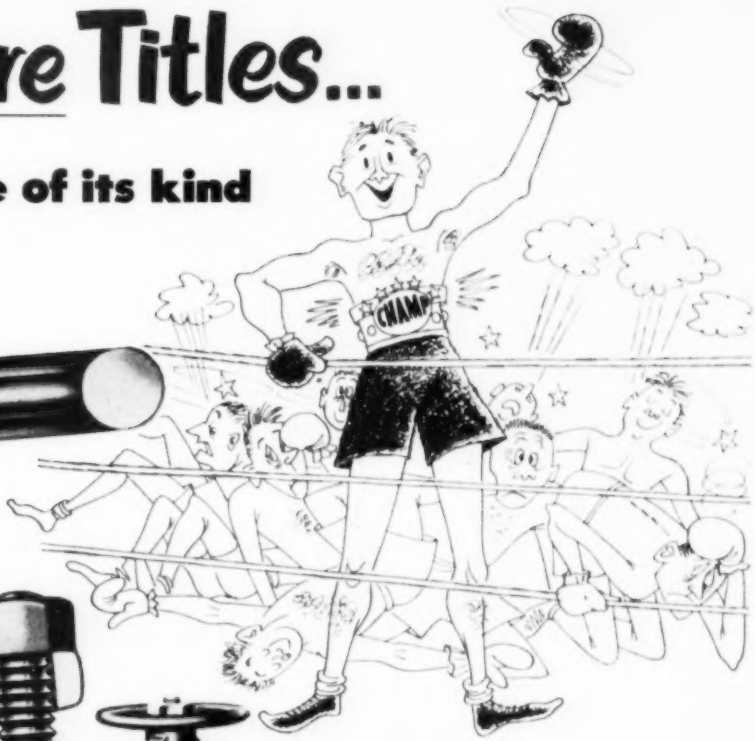
COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Latin America									
Brazilian Govt.	Sao Mateus (Santo) Brazil	Shale Oil Pilot Plt.	100 bpd.	$500,000					
Brazilian Investments	Niteroy, Rde J. Brazil	Refinery	20,000 bbls.		Petitioned				Kellogg
*CaribbeanRefiningCo.	Puerto Rico	Refinery	10,000 bbls.	$9,000,000	Under Constr.	1st Qtr., 1955		Fluor	Fluor
*Colombia Gov.	Undecided	Refinery	25,000 bbls.		Proposed				
Colombian Petro-Company	Barco Concession	Gas Treating Plt.	1 Mmcf	$5 million	Under Constr.				
Colombian Petroleum	Tibu Field	Refinery	2,000 bbls.		Tenders Out				
Colombian Petroleum	Tibu, Colombia	Gasoline Plt. Crude Stabilizer	60 Mmcf 10,000 bbls.		Engineering	4th Qtr., 1953		Fluor	Fluor
Companhia de Petroleo da Amazonia	Amazonas State, Brazil	Refinery	5,000 bbls.		Studies				
Conselho Nacional do Petroleo	Cubatao, Sao Paulo, Brazil	Therm. Crk. Ref. Reforming, Vis. Breaking Cat. Poly.	45,000 bbls.	$60,000,000	Under Constr.	Mid, 1954	Hydrocarbon Calif. Res., Shell Dev., Edeleanu	PA Hydro Res.	PA Hydro Res. and McKee
Conselho Nacional do Petroleo	Bahia, Brazil	Lube Oil Fac. Expansion	2,000 bbls. 10,000 bbls.	$12,000,000	Planned				
Conselho Nacional do Petroleo	Sao Paulo State	Refinery	30,000 bbls.		Studies				
The Corporacion de Fomento de la Produccion	Concon Valparaiso, Chile	Refinery	14,000 bbls.	$9 million	Planning	1953			
Cowden Pet. Corp.	San Juan, Puerto Rico	Refinery		$6.5 million	Planning				
Creole Pet. Corp.	Amuay Bay, Estado Falcon, Venezuela	Atmospheric Pipestill	70,000 bbls.	$44,000,000	Engineering	End 1954		Foster Wheeler	Foster Wheeler
Creole Petroleum Corp.	Amuay	Fluid Hydro-former	10,000 bbls.		Engineering	April, 1955	S.O.D.	S.O.D.	
N. V. Curacaosche Petroleum	Curacao, Netherlands Antilles	Lube Ref. Ext.	2,000 bbls.		Under Constr.	Early 1954			
Diadema Argentina	Buenos Aires	Luboil Refining	600 bbls.		Under Constr.	1954			
Empresa Nacional de Petroleo	Concon, Chile	Refinery	20,000 bbls.	$8,000,000	Under Constr.	1954		P.A., Kellogg	P.A., Kellogg
*Empresa Colombiana de Petroleos	Barrancabermeja, Colombia	Topping Unit Fluid Cat. Crk. Model IV Sulfuric Acid Alky. Unit and Offsite Fac.	30,000 bbls. 15,130 bbls. 1,600 bbls. Avgas	$30,000,000	Under Constr.	July, 1954	Standard Oil	Foster Wheeler	Foster Wheeler
International Petroleum (Colombia)	Barrancabermeja Colombia	Refinery Modernization	35,000 bbls.	$20-25 million	Under Constr.	Late 1954		Foster Wheeler	Foster Wheeler
Petroleos Mexicanos	Tamaulipas, Ciudad Madero, Mex.	Enlarge Refinery Capacity	47,250 bbls.	$22,000,000	Projected				
Petroleos Mexicanos	Tamaulipas, Arbol Grande Pet., Mex.	Enlarge Refinery	16,600 bbls.		Projected	1953-54			Staff
Petroleos Mexicanos	Mata Redonda, Vera Cruz, Mex.	Improvements			Projected	1953-54			Staff
Petroleos Mexicanos	Poza Rica, Mex.	Expansion	†100 Mmcf	$3.6 million	Under Constr.	1954		McKee	McKee
Petroleos Mexicanos	Reynosa, Mex.	Expansion	5,000 bbls.		Project	1953-54			Staff
Petroleos Mexicanos	Salamanca, Mex.	Lube Oil and Paraffin Plt.	2,200 bbls. Lube 143,000 lbs. Wax	$25,500,000	Under Constr.	Mid 1954	Texaco	McKee	Staff
Petroleos Mexicanos	Poza Rica, Vev.	Expan. Gas Absorption Purificating; Sulfur Mfg.	120 Mmcf	$20,000,000	Under Constr.	1954-55		McKee	Staff
Petroleos Mexicanos	Mexico, D.F.	Cap. Increase	30,000 bbls.	$7,000,000	Projected	1954			
Petroleos Mexicanos	Tampico, Tamps	Crude Oil Refinery Mod., Vac. Dist., Cat. Crker. & Related Fac.	75,000 bbls.	$33,000,000	Projected	1954			
Petroleos Mexicanos	Minatitlan, Vev.	Cat. Cracking	8,000 bbls.	$2,700,000	Projected	1954			
Private Group	Rio de Janeiro	Refinery	20,000 bbls.		Projected				Kellogg
Puerto Rican Oil Refining Co.	Near Ponce, Puerto Rico	Refinery	25,000 bbls.	$20 million	Projected		Undetermined	Parsons, Brinckerhoff, Hall and Macdonald	
*Refinaria de Manguinhos S.A.	Rio de Janeiro, Brazil	Therm Crk. Vis. Breaking	10,000 bbls.	$12,000,000	Under Constr.	End 1954	Edeleanu	Kellogg PA	Kellogg PA
Rafinaria de Petroleos de Manguinhos S.A.	Manguinhos, Brazil	Refinery	10,000 bbls.	$10 million	Contracted	1954		Kellogg	Kellogg
* Refinaria de Petroleo UNIAO	Capuava Sao Paulo, Brazil	Cat. Crk. TCC Cat Poly.	20,000 bbls.	$15,000,000	Under Constr.	End 1954	Soc. Vac. St. Calif.	PA Hydrocarbon	P.A. Hydrocarbon
Refinaria e Exploracoa de Petroleo "Uniao" S.A.	Capuava, Sao Paulo, Brazil	TCC Recovery Cat. Poly.	20,000 bbls.		Under Constr.	1954	Hydrocarbon Calif. Res., So-Vac.	Hydrocarbon	Hydrocarbon
*Refinaria Ipiranga S.A.	Rio Grande, R. G., Brazil	Ther. Crk.	5,000 bbls.		Test runs			Foster Wheeler	Foster Wheeler
Reunidas F Materazzo	Sao Paulo, Brazil	Contact Sulfur Acid Plt.	60 tons		Ordered				Chemico
Richmond Exploration Company	Bajo Grande, Venezuela	New Refinery	35,000 bbls.		Referred				
Trinidad Leaseholds, Ltd.	Trinidad	Refinery Addition		$300,000	Designing			H.W.P.	H.W.P.
Yacimientos Petroliferos Fiscales	Eva Peron, Argentina	Refinery	28,300 bbls.					Kellogg	Kellogg
Europe and Africa									
Albatros S.A. Pour le Raffinage de Petrol	Antwerp, Belgium	Houdriflow Cat. Crker	4,000 bbls.		Under Constr.	Late 1953	Houdry	H.W.P.	H.W.P.
Albatros S.A. pou le Raffinage de Petrole	Antwerp, Belgium	Expansion	12,000 bbls.		Under Constr.	1954		Petrocarbon, Ltd.	Petrocarbon, Ltd.
Anglo-Iranian Oil	Kent, England	Rerun Unit	2,100 bbls.		Completed				
Anglo-Iranian Oil	Kent, England	Solutizer	5,400 bbls.		Completed				
Anglo-Iranian Oil	Kent, England	Cu Chloride	4 x 7,000 bbls.		Completed				
Anglo-Iranian Oil	Kent, England	Acid Soda Treat	2,100 bbls.		Under Constr.				
Anglo-Iranian Oil	Kent, England	Propane Deasph.	4,500 bbls.		Under Constr.			Kellogg	Kellogg
Anglo-Iranian Oil	Kent, England	Furfural Extrac.	5,800 bbls.		Under Constr.		Texaco	Lummus	Lummus
Anglo-Iranian Oil	Kent, England	MEK Dewaxing	4,500 bbls.		Under Constr.		Texaco	Foster Wheeler	Foster Wheeler
Anglo-Iranian Oil	Kent, England	Clay Contact	3,120 bbls.		Under Constr.			Lummus	Lummus
Anglo-Iranian Oil	Kent, England	Fluid Cat. Crk.	10,000 bbls.		Completing			Kellogg	Kellogg
*Anglo-Iranian Oil	Kent, England	Platformer	6,000 bbls.		Planned		U.O.P.	Badger	Badger
*Anglo-Iranian Oil	Kent, England	Vacuum Units (two of)	17,000 bbls.		Under Constr.			Badger	Badger

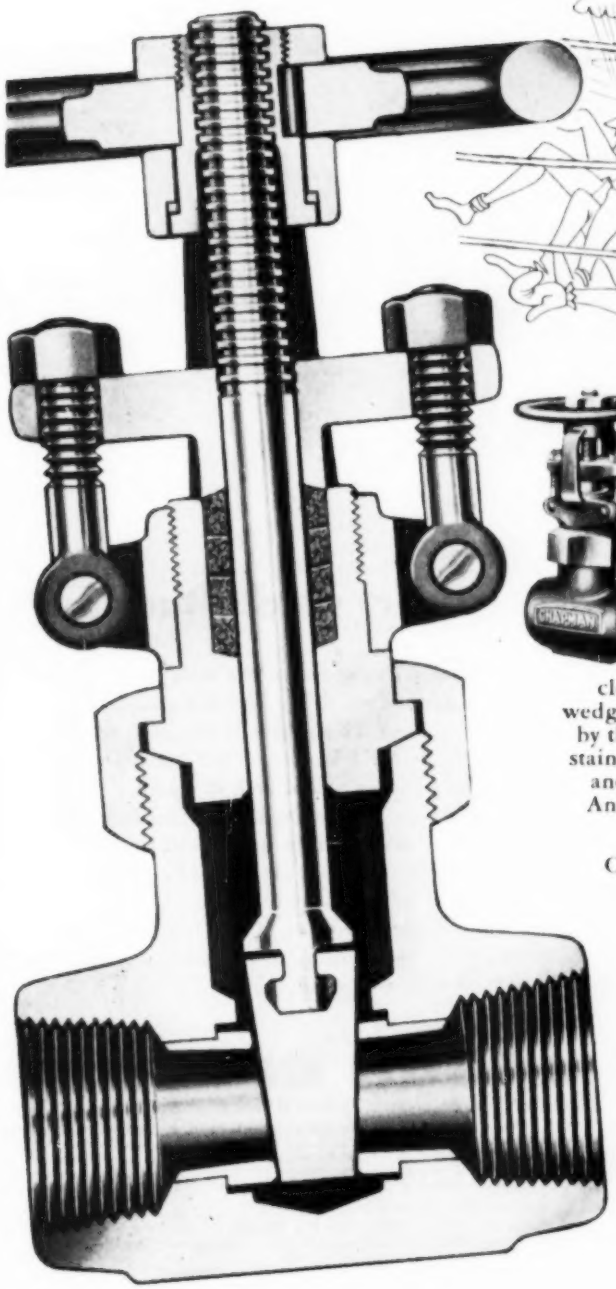
Table continued on page 205

CHAPMAN LIST 960

Holds More Titles...

than any valve of its kind





Yes, here's the champ of all small forged steel gate valves! It has licked more different jobs than you can shake a stick at . . . and stays in there fighting with all the *extra stamina* you get in *every* Chapman Valve.

Here are the reasons why: Extra protection against even unusual stress when opening and closing the valve is provided by extra-strong stem-and-wedge-gate connection. Repairs and replacements are cut by the use of super-hardened seat rings and gate faces of stainless steel. Forged body and yoke are longer-lived . . . and bolted follower has no threads on yoke to corrode. And lastly, gate faces won't seize or gall because they're *Malcomized* (Chapman patent) to 800 Brinell.

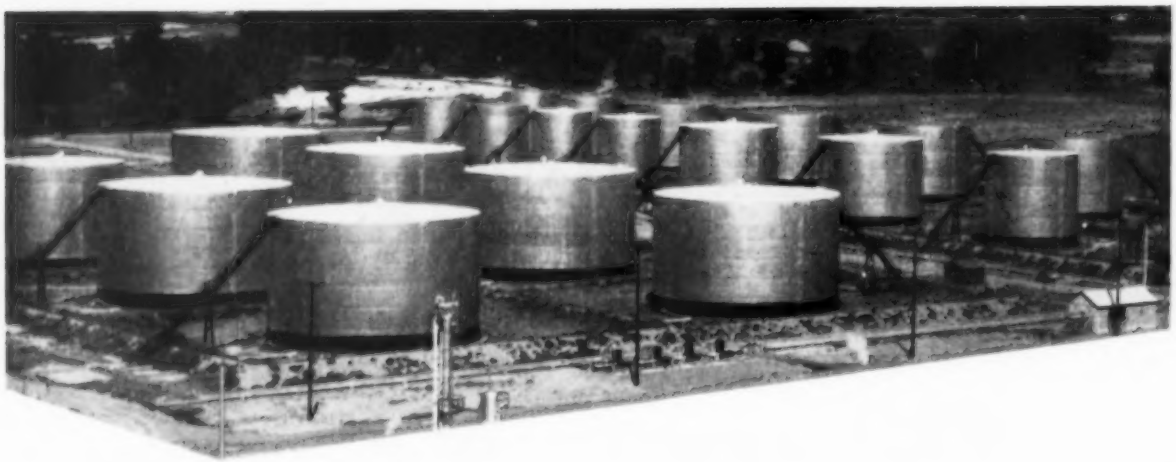
Chapman List 960 Forged Steel Gate Valves are made in sizes from ½" to 2" inclusive . . . with rising stem with yoke (shown) or with rising stem with inside screw. Bonnet joints are either gasketed or metal to metal. Pressure range: 2,000 lb. at 100° F. — 380 lb. at 1,000° F. For higher pressures, specify List 990. And for full details on List 960, send today for your copy of Catalog 10.

THE

CHAPMAN

VALVE MFG. CO.

INDIAN ORCHARD, MASS.



to be sure your HORTON tanks are the best . . .

Chicago Bridge & Iron Company assigns a Field Welding Supervisor to inspect every welded tank built

It takes the knowledge of an expert and as much supervision as possible to build a really good welded steel structure. Knowing this, Chicago Bridge & Iron Company assigns a Field Welding Supervisor, in addition to the regular Foreman in charge, to inspect every tank built. The Supervisor assists the Foreman in cutting and grading plugs, magnafluxing, x-raying and stress-relieving welded joints as called for in governing specifications. He helps to check welding equipment and welding techniques and if necessary will train and qualify welders to assure top skill and capacity on a job.

The Field Welding Supervisor does everything possible to assure you of the best tank your money can buy . . . and it's all done at *no extra cost* to you! Complete Field Welding Supervision Service is provided on every welded tank we build.

Expert design, fabrication and erection facilities for welded steel plate structures is offered to the petroleum industry by our experienced engineering staff, plants and field crews. When planning a welded steel plate structure of any type write our nearest office for estimates or quotations . . . there is no obligation on your part.

CHICAGO BRIDGE & IRON COMPANY

Plants in **BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA**

Atlanta 3	2146 Healey Building	Detroit 26	1520 Lafayette Building	Philadelphia 3	1608—1700 Walnut Street Building
Birmingham 1	1548 North Fiftieth Street	Havana	402 Abreu Building	Pittsburgh 19	3237 Alcoa Building
Boston 10	1030—201 Devonshire Street	Houston 2	2126 C & I Life Building	San Francisco 4	1551—200 Bush Street
Chicago 4	2463 McCormick Building	Los Angeles 17	1534 General Petroleum Building	Seattle 1	1331 Henry Building
Cleveland 15	2234 Midland Building	New York 6	3302—165 Broadway Building	Tulsa 3	1626 Hunt Building

REPRESENTATIVES AND LICENSEES

Ateliers et Chantiers de la Seine Maritime, Paris, France
Compagnia Tecnia Industrie Petroli, Rome, Italy
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348, Caracas, Venezuela
Sociedade Chibridge de Construcoes Ltda., Av. General Justo, 275, Grupo 306, Rio de Janeiro, Brazil
Horton Steel Works Limited Fort Erie, Ontario, Canada
Motherwell Bridge & Engineering Company, Motherwell, Scotland
Whessoe, Limited, Darlington, England
Comarimo N. V., 21 Amstel, Amsterdam (C) Netherlands

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

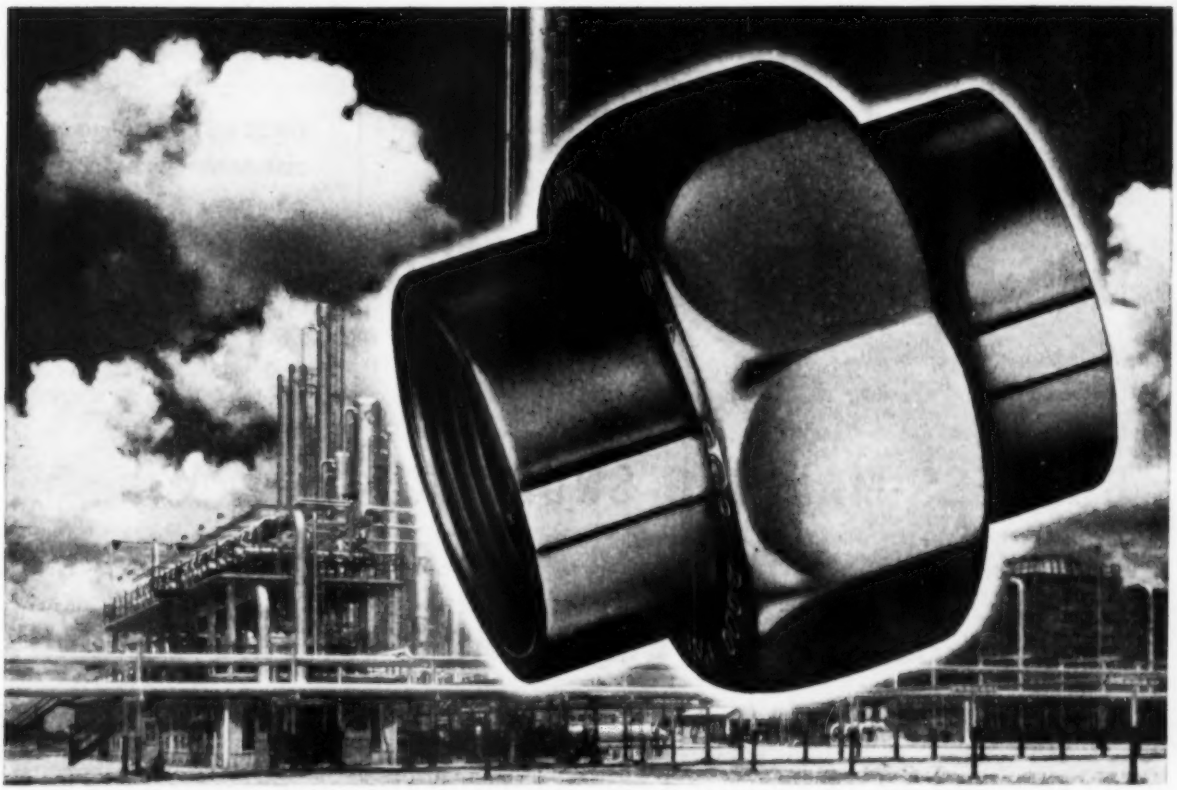
COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Anglo-Iranian Oil	Schindler, Germany	Furfural Trtg. Plt.			Under Constr.				
Anglo-Transvaal Consolidated Investment Co.	Vall River, Union of South Africa	Synthetic Gasoline and Diesel Oil Plt.		$50-60 million	Contracted			Hydro. Res.	
Atlantique Progil-Electro-Chemie	Donges, France	Cumene Plt.	326 bbls.	$1,000,000	Completing		Hercules	Hydrocarbon	Hydrocarbon
Bataafsche Petroleum Maatschappij	Pernis, Holland	Expansion	†65,700 bbls.		Under Constr.	Late, 1953			
N. V. de Bataafsche Petroleum Maatschappij	Pernis, Netherlands	Luboil Ref. Exp. solvents Plt.	1,750 bbls. 16,000 tons/yr.		Under Constr. Under Constr.	Early, 1955 May, 1954			
Benzene und Pet. Co. of Hamburg	Hamburg-Finkenwerder, Germany	Expansion	660,000 bbls.		Announced				
B. P. Benzin	Hamburg, Germ.	Distil. Unit			Planned				Staff
B. P. Benzin	Hamburg, Germ.	Platformer	6,000 bbls.		Planned		U.O.P.		Procon
Compania Espagnole de Petroles, S. A.	Santa Cruz de Tenerife	Platforming Unit	5,000 bbls.	$1 milliom	Completing		U.O.P.	U.O.P.	Procon
Condor, S.P.A. Per l'Industriale Pet. Chemica	Rho, Italy	Cat. Crker.	†15,000 bbls.		Under Constr.	1953	So-Vac	Badger Div.	Badger Div.
Condor	Rho, Italy	Atm. Dist. Plt.	45,000 bbls.		Under Constr.	1953		Badger Div.	Badger Div.
Deutsche-Amerikanische Petro-Gesellschaft (Esso)	Hamburg-Harburg, Germany	Cracking Plt. and Expansion	8,843 bbls.	$10 million	Under Constr.	Jan., 1954		S.O.D.	Gutte-Hutte
Egyptian Government	Cairo, Egypt	Crude Plt.						Lummus	Lummus
Egyptian Government	Suez, Egypt	Inc. Refn. Cap.	26,000 bbls.	$2,500 000	Planning				Lummus
Empresa Nacional "Calvo Sotelo"	Puertollano, Spain	Shale Oil Refg.	3,000 bbls.	$46,000,000	Under Constr.	1954	Basf, Lurgo	Basf, Lurgi	Basf, Lurgi
Esso Stand. Hatesana.	Genoa, Italy	Cap. Increase Incl. Crker.							
Esso Standard, Societe Anonyme Francaise	Port Jerome, France	Double Stage Pipestill	25,000 bbls.	$3,715,000	Under Constr.	Mid 1954		Foster Wheeler	Foster Wheeler
Garrane	Genoa, Italy	Cap. Increase							
Greek Government	Greece	Refinery	25,000 bbls.	$20,000,000	Planned				
Gulf Oil Corp.	Antwerp, Belgium	Refinery	20,000 bbls.		Considering				
Industria Petrolifera e Chimica	Milan, Italy	Gasoline Fuel Oil Plt.	20,000 bbls.					Dr. Calogero Unglogio	
Imperial Chemical Industries, Ltd.	Wilton, Yorkshire, England	Petroleum Cracking Unit	2,000 bbls.		Completed			Kellogg	Kellogg
Kali Chemie Co	Nienberg, Germany	Bead Catalyst Plt.			Licensed		So-Vac.		
Manchester Oil Refinery, Ltd.	Partington, England	New Lube Refinery	30,000 bbls.		Projected				
Mineraoel-und Asphaltwerke, A.G.	Ostermoor Germany	Reconstruction	1,196 bbls.						
Monsanto Chemical Company	Britain	Add Polystyrene			Under Constr.			Staff	Staff
Montecatini Co.	Ferrara, Italy	Olefin Plt.	450 bbls.	$18.6 million	Completing			Kellogg	Kellogg
A. P. Moeller	Copenhagen, Denmark	Thermal Cracking Plt.	2,000 bbls.	$3.5 million	Field Work				
National Oil Refineries, Ltd.	Llandarcy	Platformer	6,000 bbls.	$3 million	Engineering	End 1954	U.O.P.	Procon	Badger
National Oil Refineries	Llandarcy	SO_2 Kerosine Extraction	3,000 bbls.	$1 million	Completed				
*National Oil Refineries	Llandarcy	Wax Treating	350 bbls.	$1,400,000	Completing	End 1953		Badger	Badger
A/S Norsk Amerikansk Mineraloljekompagni	Vallo, near Tonberg, Norway	Lube Oil, Asphalt	1,000 bbls.						
Pechelbronn, S. A. E. M.	Merkwiller, France	Cap. Increase	1,550 bbls.		Authorized				
Permolio	Genoa, Italy	Cap. Increase							
Raffineries Francaises	Donges, France	T. C. C. Unit	10,000 bbls.		Under Constr.	Jan., 1954	So.-Vac.	Hydrocarbon	Hydrocarbon
		Thermal Reforming	4,000 bbls.		Completed			Staff	Staff
		Topping-Vacuum Unit	4,000 bbls.		Completed			Staff	Staff
Refineria de Petroleos de Escombreras S. A., (REPESA)	Escombreras Spain	Lube Oil Plt.	20,000 tons/yr. Nominal Cap.		Planning	1955		Foster Wheeler	Foster Wheeler
S. A. Conc. Ref. Pet. em Portugal	Cabo Riuvo Plt., Portugal	Topping Unit	29,000 bbls.		Under Constr.			Koch	Koch
S. A. Conc. Ref. Pet.	Cabo Riuvo Plt.	Cracking Unit	5,000 bbls.				So-Vac.	Hydro-Res.	Hydro-Res.
S. A. Conc. Ref. Pet.	Cabo Riuvo Plt.	Reformer	2,500 bbls.						
Shell Oil Company	Rotterdam, Holland	Distillation Plt.	†3.2 million tons	$5.6 million		Late, 1953			
Sociedade Anonima Concessionaria em Portugal	Cabo Riuvo, Portugal	T.C.C. Gas Rec. Cat. Polv., Vac. Dist., Sweetening	11,000 bbls.		Completing		So.-Vac., Hydro-Carbon, Calif. Res. Edeleanu	Hydrocarbon	Hydrocarbon, Staff
Sociedade Anonima Concessionaria da Rafinacao de Petroleos em Portugal	Cabo Riuvo, Portugal	Kerosine Diesel & Lube Extrac	6,600 bbls.		Engineering	1954	Edeleanu	Edeleanu	
*Societa Per Azioni Raffineria Padana Olii Minerali (SARPOM)	San Martino di Trecate (Novara), Italy	Cat Cracker	2,880 bbls.		Planning	1955		U.O.P.	E. B. Badger
		Vacuum Unit	5,150 bbls.		Planning	1955		E. B. Badger	E. B. Badger
		Poly Plant	315 bbls.		Planning	1955			E. B. Badger
Societe Cherifienne des Petroles	Petitjean, Morocco	Feed Prep., T. C.C. Recov.	2,700 bbls.		Under Constr.	1954	So.-Vac.	Hydrocarbon	Hydrocarbon
*Societe des Raffineries de Petrole de la Gironde	Ambes, France	Platformer	1,800 bbls.		Planning	1955	U.O.P.	U.O.P.	
*Societe Generale Huile Petroles	Lavera, France	Platformer	6,000 bbls.		Under Constr.	End, 1954	U.O.P.	Procon	Badger
Societe Industrielle Belge des Petroles	Antwerp, Belgium	Cat. Crker.	10,000 bbls.		Planned		U.O.P.	Lummus	Lummus
S.I.B.P.	Antwerp, Belgium	Cat. Poly. Unit	3,000 bbls.		Planned		U.O.P.	Lummus	Lummus
Socony-Vacuum Italiana, S.P.A.	Naples, Italy	Cat. Poly.		$724,000	Design	Late 1954	Calif. Res.	Bechtel	Bechtel
Socony-Vacuum Italiana, S.P.A.	Naples, Italy	TCC			Design	Late 1954	Soc-Vac	Bechtel	Bechtel
South Africa Coal Oil & Gas Petrolifera	Coaltrook, Orange Free St.	Plt. Ref. Expan. and Expan.	3,500 bbls 33,000 bbls.	$50.4 million $20,000,000	Under Constr. Completing	1955	S.O.D., Staff	Kellogg S.O.D., Staff	Kellogg Badger

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Standard (N.J.)	Hamburg, Germany	General Expan.	32,000 bbls.	$10 million	Plan	Jan., 1954		S.O.D.	Gutehoffnung-Schutte
Standard-Vacuum Ref. of South Africa	Wentworth, Durban, Union of S. Africa	Refinery	15,600 bbls.	$17 million	Under Constr.	Jan., 1954		S.O.D.	Foster Wheeler
Trent Oil Prod. Development Co.	North Shields, England	Crude Plt.	11,500 bbls.	$4.8 million	Plans Approved				
Turkish Institute of Minerals Prospecting	Southeastern, Turkey	Refinery	6,000 bbls.	$7,000,000	Projected	End 1954		Parsons	Parsons
Union Petrol Refinery Ltd.	Johannesburg, Union of South Africa	New Refinery		$20 million	Projected				
*Universal-Motthey & Co.	England	Platform Cat.			Planned	Mid 1954			Procon
Vacuum Oil Co., Ltd.	Birkenhead, Eng.	Grease Plt.		$28 million	Under Constr.	Completing			
Vacuum Oil Co.	Coryton, Eng.	Refinery	17,000 bbls.	$30 million	Completing		Texaco	Lummus	Lummus
Near East									
Anglo-Iranian	Aden	New Refinery	100,000 bbls.		Under Constr.	1954		G. Wimpey (London) Middle East Bechtel	Middle East Bechtel Staff
Arabian American Oil Company	Ras Tanura, Saudi Arabia	Lt. Str. Run Caustic Wash and Electrolic Process for Regenerating Spent Caustic	25,000 bbls.		Engineering	Dec., 1953	Amer. Dev. Co.	Aramco	
Bahrain Pet. Co.	Bahrain	Mod. of FCCU	26,000 bbls.		Under Constr.	1954		Staff, U.O.P.	Staff
Consolidated Ref., Ltd.	Haifa, Palestine	Gen. Facilities Conversion of Kellogg Comb-Top. and Crk.	35,000 bbls.		Planned			Badger Div.	
Iraq Government	Baghdad Area	Refinery	24,000 bbls.	$25.2 million	Contracted	Spring, 1954		Kellogg	Kellogg
Israeli Government	Haifa, Palestine	Petro Chem. Plt.	10 tons	$2.5 million	Under Constr.				Staff
Mediterranean Refining Co.	Sidon, Lebanon	Refinery	6,250 bbls.		Under Constr.		U.O.P.	G. S. Culley, Procon	G. S. Culley
Turkey Government	Ramandag Field	Refinery	3,000 bbls.	$5.5 million	Planning				
Far East									
Bataafsche Pet. Mij. (Shell)	Balikpapan, Borneo, East Indies	Expansion	44,000 bbls.		Under Constr.	Early, 1955			
Bataafsche Pet. Mij.	Tjepu, Java	Rebuild TEL Blending Unit & Dist. Unit			Planning				
*Burmah Oil Co.	Pakistan	Refinery			Proposed				
Burmah Shell	Bombay, India	Refinery	40,000 bbls.	$47 million	Projected	1955			
Daikyo Oil Co.	Yokkaichi, Japan	Houdriflow	4,200 bbls.		Projected		Houdry		Houdry
Koa Oil Co., Ltd.	Marifu, Japan	Platformer	1,200 bbls.		Under Constr.	1954	U.O.P.	U.O.P.	Local
Maruzen Oil Co., Ltd.	Wakayama Prefecture, Japan	Cat. Crker., Dist. Increase	†3,000 bbls. †15,500 bbls.		Completing				
Mitsubishi Oil Co. Ltd.	Tokyo, Japan	Vacuum Distillation Unit	2,000 bbls.						
Mitsubishi Oil	Tokyo, Japan	Solvent Extraction & Dewaxing Processes					Texaco Dev.		
Nippon Petroleum Refining Co., Ltd.	Yokohama, Japan	Modern. and Expansion	12,000 bbls.		Under Constr.	1955		McKee	McKee
Nippon Petroleum Refining Co., Ltd.	Kudamatsu, Japan	Platformer	1,200 bbls.		Under Constr.	1954	U.O.P.	U.O.P.	Local
*Showa Oil Co., Ltd.	Tokyo, Japan	Platform. Unit	1,300 bbls.		Planning		U.O.P.	U.O.P.	Japan Gasoline Co.
Standard-Vacuum Refin. Co. of India	Bombay, India	Refinery	25,000 bbls.	$32,500,000	Under Constr.	July, 1954		S.O.D.	Lummus
Oceania									
A. I. O. C.	Kwinana, Australia	Refinery	60,000 bbls.		Under Constr.				Kellogg, Kellogg International, Costain-John Brown
Australian Oil Refining, Ltd.	Kurnell, Australia	Refinery	22,000 bbls.		Under Constr.	1955		Badger, Ewbank & Partners, Christiani & Nielson, Foster-Wheeler	Badger
Australian Shell Oil	Geelong	Crude Dist.	25,000 bbls.	$12 million	Under Constr.	Mid 1954			
Australian Shell	Geelong, Victoria, Australia	Bitumen and Lubsol Plt.		$10 million	Projected	Late 1953			
Australian Shell	Geelong, Victoria, Australia	Asphalt, Lubs Sol. Extct. Plt.			Projected	Late 1953			
Australian Shell	Melbourne, Australia	New Refinery	22,000 bbls.		Completed				
Australian Shell	Port Phillip Bay, Victoria	Refinery	20,000 bbls.	$9 million	Under Constr.	1954			
Caltex (Philippines, Inc.)	Batangas, P.I.	Refinery	13,000 bbls.		Under Constr.	1954		Foster Wheeler, McKee	Foster Wheeler
Standard-Vacuum Refining Co., Ltd.	Melbourne, Aust.	Refinery	20,000 bbls.	$30 million	Under Constr.	Jan., 1955		Braun, Staff	Braun

* First appearance in tabulation. † Added capacity.

NOTE: Atlantic—Atlantic Ref. Co. Austin—Austin Co. Badger Div.—Stone & Webster Engineering Co. Barnes—W. M. Barnes Co. Bechtel—Bechtel Corp. Blaw—Blaw-Knox Construction Co. Braun—C. F. Braun Co. Brown & Root—Brown & Root Construction Co. Buckner—F. J. Buckner Corp. Calif. Res.—California Research Corp. Can. Kellogg—Canadian Kellogg Co. Cat. Constr.—Catalytic Construction Co. Chemico—Chemical Construction Co. Ch. Pro.—Chemical Process, Inc. C. B. & I.—Chicago Bridge & Iron Works Company Chiyoda—Chiyoda Chemical Engineering & Construction Co., Ltd. C. & I.—Chemical & Industrial Corp. Consd. Eng.—Consolidated Engineering Company Craig—A. F. Craig & Co. D & Z—Day & Zimmerman Delta—Delta Engineering Corp. Dresser—Dresser Engineering Corp. Ebasco—Ebasco Services, Inc. E&A—Ehrhart & Arthur, Inc. Edeleanu—Edeleanu Gesellschaft M. B. H. Fish—The Fish Engineering Corp. Ferguson—H. K. Ferguson Co. Fluor—Fluor Corp. Gas Plant Constr.—Gasoline Plant Construction Corporation Graff—Graff Engineering & Equipment Grebe & Doremus—Grebe & Doremus Process Co. Gutte-Hutte—Gutte Hofnungs Hutte Hercules—Hercules Powder Co. Hudson—Hudson Engineering Corp. H.W.P.—Head Wrightson Process, Ltd. Hydrocarbon—Hydrocarbon Research Inc. Hydro M—Hydrocarbon Mineraloel G.m.b.H. Hydro E—Hydrocarbon Engineering S.A.R.L. Kaiser—Kaiser Engineers Kellogg—The M. W. Kellogg Co. Kellogg—P. A.—Kellogg Pan-American Koch—Koch Engineering Company Koppers—Koppers Co., Inc. Lummus—The Lummus Co. Macco—Macco Corp. McKee—Arthur G. McKee Co. M-C & S—Merritt-Chapman & Scott Corp. C. L. Olson P. A. HydroRes—Pan-American Hydrocarbon Research Co. Parker—Parker, Steffens & Pearce Parsons—The Ralph M. Parsons Co. Petco—Petroleum Engineering Tool Co. Phillips—Phillips Petroleum Co. Pritchard—J. H. Pritchard Co. Procon—Procon, Inc. Quaker—Quaker Valley Constructors Ref. Eng.—Refinery Engineering Company Rust—Rust Engr. Co. S & B—Singmaster & Breyer Separator-Nobel Co. Socony-Vac.—Socony-Vacuum Oil Co. Southwestern—Southwestern Constr. Co. S. O. D.—Standard Oil Development Co. Sohio—Standard Oil Co. of Ohio Stearns-Roger—Stearns-Roger Manufacturing Co. Stone & Webster—Stone & Webster Construction Co. Sunland—Sunland Refining Company Sweco—Southwestern Engineering Co. Tears—Tears Engineers Tellepsen—Tellapsen Construction Company Texaco Dev.—Texaco Development Corp. Texaco—The Texas Co. Texas Natural—Texas Natural Gasoline Corp. U.O.P.—Universal Oil Products Company J. G. White—J. G. White Eng. Corp.



Designed Especially for the Oil and Gas Industries, Rockwood cold-forged steel Unions have been tested and listed by Underwriters' Laboratories, Inc., for use in handling flammable liquids and gases.

More Strength where you need it most!

Potential trouble spots get tops in protection when you use Rockwood Unions.

Every detail of their new design is planned to increase your safety margin and cut replacement costs. The breaking load of the 3″ size, for example, is 118,000 lbs., for greater resistance to jarring, vibration, expansion and construction-shock. This extra tensile strength is evenly distributed, also, thanks to over-all balance which makes each of the three parts equally rugged.

The non-corrosive seats are double-locked in place under pressures of 100,000 and 400,000 lbs. Being integral with the Union they can't work loose. And their plug-type ball-to-cone construction eliminates sharp corners and edges. You get quick, easy alignment.

Cold forging enables making these seats of either stainless steel or Moly 341, which means no possibility of corrosion at the seat joint. In addition, all Rockwood Unions are "Rockwoodized" against corrosion by a special coating process — and absolute interchangeability of parts completes the list of solid advantages you get when you specify Rockwood Unions. For full information, write Rockwood Sprinkler Company, 102 Harlow Street, Worcester 5, Mass.

Checked For Extra Strength. Determining tensile strength is a typical feature of Rockwood's thorough quality control. Unions are taken regularly from production and tested in this machine. Average breaking loads for the 1″, 2″ and 3″ sizes are 24,000, 82,000 and 118,000 lbs., respectively — extra strength for toughest service.

Special Non-Corrosive Seats are a big Rockwood advantage. Specify Rockwood Type 602 Union with two stainless steel seats — or Rockwood Type 603 Union with two Moly 341 seats.

ROCKWOOD

ROCKWOOD

SPRINKLER COMPANY

MANUFACTURERS OF THE MOST COMPLETE LINE OF STEEL UNIONS ON THE MARKET

WORCESTER 5, MASSACHUSETTS

Again!

Gas Pulsation Prevented

by

BURGESS-MANNING SNUBBERS

THESE OUTSTANDING COMPANIES PLACED THEIR CONFIDENCE IN BURGESS-MANNING

Oklahoma Natural Gas Company
Continental Oil Company
Midcontinent Petroleum Corp.
Skelly Oil Company
Standard Oil Company of Ohio
Public Service Company of Northern Illinois
Peoples Gas Light & Coke Co.
Aurora Gasoline Company
Pacific Gas & Electric Company
Union Oil Company of California

BURGESS-MANNING

☑ ENGINEERING
☑ DESIGN
☑ KNOW-HOW
for
☑ Best Performance in Operation

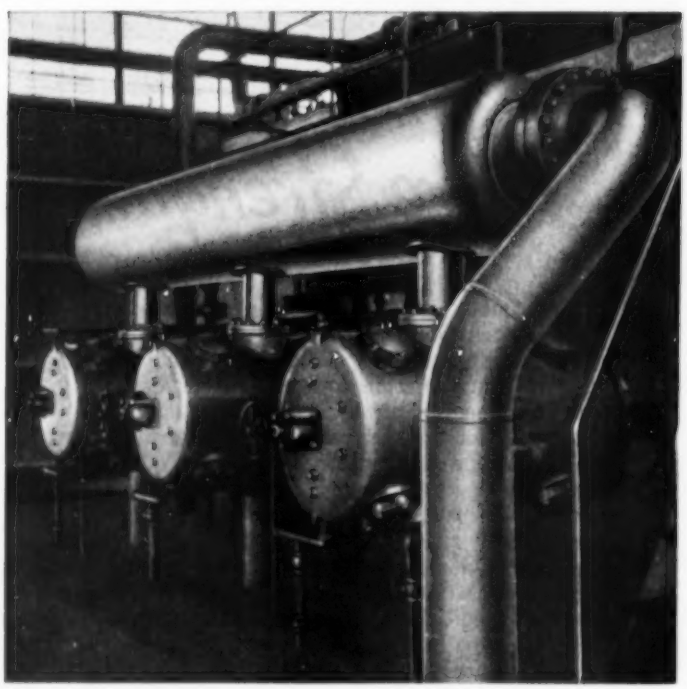
Individually engineered and designed Burgess-Manning Snubbers effectively control pulsation in gas and air piping excited by compressors, blowers, or reciprocating pumps. Pulsation control prevents line vibration and equipment fatigue with improved gas flow.

Smoother gas flow allows for best efficiency,
process action,
gas transmission,
and gas measurement.

We invite you to write for your copy of an actual field report in survey and analysis of surge control with Burgess-Manning Pulsation Snubbers.

PACIFIC GAS & ELECTRIC COMPANY

Burgess-Manning Pulsation Snubbers installed on a gas compressor in the Topock Station of Pacific Gas & Electric Company



BURGESS-MANNING COMPANY

SOUND ENGINEERING

1203 DRAGON STREET
Dallas, Texas

CHICAGO, ILLINOIS • LIBERTYVILLE, ILLINOIS • REPRESENTATIVES: HOUSTON • TULSA • LOS ANGELES • ST. LOUIS • NEW YORK

What's **Happening** in the Industry...

Texaco Appoints Kerryn King Public Relations Director

Kerryn King, senior vice president of Hill and Knowlton, Inc., public relations counsel for The Texas Company, has been appointed public relations director of Texaco. King has been associated with Hill and Knowlton since 1943 and has been in charge of its work for Texaco.

King

During the past ten years, King has supervised public relations activities for various clients of the firm, including leading corporations in the field of oil well drilling equipment and supplies. He formerly was associated with Consolidated Vultee Aircraft Corporation, Fort Worth, Texas, and Texas Power and Light Company, Dallas.

PAD Removes Controls on Use Of Alkylates in Auto Gasoline

Suspending, at least for three months, Order No. 3 that prohibited use of alkylates in automotive gasoline, PAD has pushed aside the last roadblock to octane competition. Extension of the suspension (from October 1 through December 31) will depend upon the response industry makes to new bids to be submitted by the military for avgas requirements for the first half 1954, PAD has reported.

Reasons given by the agency for the suspension were: avgas production has been shown to be greater than anticipated earlier; and steel plate shortage has slowed storage expansion and prevented the military from taking more avgas (although its needs have been covered).

The latter condition has prompted the Armed Services Petroleum Purchasing Agency to intensify the search for leased storage and to ask refiners to stock up on avgas now to meet increased needs for the first half of 1954 (which may exceed production schedules).

Esso Export Elects Parker To Executive Vice President

George M. Parker, vice president, Esso Export Corporation, has been elected executive vice president. He succeeds L. K. Blood, who has vacated the position after more than 40 years with Jersey Standard's affiliated companies. Blood will continue as a director and will be available for special assignments.

Mekler Moves Practice From Palo Alto to New York City

L. A. Mekler, well-known consulting engineer, has moved from Palo Alto, Calif., to 525 Lexington Avenue, New York. He will continue as independent consultant on thermal phases of petroleum refining, petrochemicals, and other thermochemical and thermophysical processes.

API Sessions in Chicago Next Month May Establish New Attendance Record

An address on atomic energy promises to be one of the highlights of the 33rd annual meeting of the American Petroleum Institute to be held in Chicago November 9 through 12, inclusive. W. L. Davidson, director of the Office of Industrial Development, U. S. Atomic Energy Commission, will deliver the address to the transportation group session in the Palmer House, Monday afternoon, November 9.

Preliminary program released by the Institute reports that indications are that the 1953 attendance will break last year's record attendance of 6393. The annual meeting usually attracts over 5000 representatives of the oil industry, business and government. More than likely the 1953 attendance mark will push the total registered attendance since annual meetings were started in 1920 to a grand total of well over 90,000.

Principal speakers at the two general sessions, to be held on the mornings of November 11 and 12, include Douglas McKay, U. S. Secretary of Interior, and Petroleum Administrator for Defense; Johnston Murray, governor of Oklahoma; P. C. Spencer, president of Sinclair Oil Corporation; and Frank M. Porter, president of API. L. S. Wescoat, API chairman of the board, and president of The Pure Oil Company, will preside at both general sessions.

Conrad Hilton Hotel will again serve as headquarters for the meeting, and, as was the case last year, all sessions and committee meetings will be held there, except those of the Division of Transportation which will be held in the Palmer House.

Board Meeting

API Board of Directors will meet all day Tuesday, November 10, and on the afternoon of the following day.

Another outstanding feature of the annual meeting will be the award of the API's Gold Medal for Distinguished Achievement—one of the nation's highest industrial awards. Presentation will be during the general session on Wednesday morning in the Grand Ball Room of the Conrad Hilton. Name of the recipient will be announced later.

The Division of Refining's Group Session will be held on the afternoon of November 9, with John W. Newton, vice president of Magnolia Petroleum Company, presiding. This session will hear the report of the Division's nominating committee, elect members of the general committee of the Division of Refining, and hear papers on two new refining processes. The first paper, "Fluid Coking of Residua," is by A. Voorhies, Jr., Esso Standard Oil Company, and H. Z. Martin, Standard Oil Development Company. The other paper, "Lummus Continuous Contact Coking Process," is by Valentine Mekler, A. H. Schutte, and T. T. Whipple, Lummus Company.

Sessions Scheduled

Other sessions with chairmen include:

Thursday, November 5—Division of Refining, Subcommittee on Corrosion (all day), E. Q. Camp. This group will also meet November 6, with Camp as chairman.

Saturday, November 7—Division of Refining, Joint Committee (all day); subcommittee on Low-Pressure Storage Tanks, W. L. Bowler; Manufacturers' Subcommittee on Low-Pressure Storage Tanks, H. C. Boardman; with W. L. Bowler presiding. Manufacturers' Subcommittee on Refinery Valves, W. P. Kliment. Manufacturers' Subcommittee on Safety and Relief Valves, L. P. Stillman.

Sunday, November 8—Division of Refining Committee on Petroleum Products, A. E. Miller. Joint Meeting: Subcommittee on Mechanical Equipment, E. F. Voss; Manufacturers' Subcommittee on Centrifugal Pumps, Lynn Sawyer; with E. F. Voss presiding. Automotive Research Committee, John T. McCoy. Joint Meeting: Subcommittee of Refinery Inspection Supervisors, W. K. Brown; Designers' Subcommittee on Refinery Inspection, J. H. Rickerman; with W. K. Brown presiding. Subcommittee on Valves, R. H. Bungay.

Monday, November 9—Division of Refining Subcommittee on Unfired Pressure Vessels, N. J. Rees. Program Committee, Division of Refining, C. M. Eldgway. Subcommittee on Instruments, G. N. Ehly. Subcommittee on Elecectrical Equipment, L. M. Goldsmith. Nominating Committee, Division of Refining, L. C. Burroughs. Advisory Committee, Division of Refining, E. B. McConnell. Smoke and Fumes Technical Advisory Committee, H. G. Vesper.

Group Session, Fundamental Research. Research on Occurrence and Recovery of Petroleum, T. W. Nelson, Socony-Vacuum Oil Company. Speakers include: Robert E. Wilson,

Ohio Oil Names Luton and Stover Vice Presidents

N. T. Stover has been elected vice president in charge of marketing and

Luton Stover

R. E. Luton vice president in charge of refining by The Ohio Oil Company. Stover formerly was general sales manager and Luton was manager of the Refining division.

Establishment of the two new vice presidential offices follows the recent election of C. Z. Hardwick as executive vice president. Peviously, Hardwick served as manager of refining and marketing.

Stover began his career with The Ohio Oil Company in 1913.

Luton served as assistant superintendent and chemist of Lincoln Oil Refining Company at Robinson, Ill., which Ohio acquired in 1924. When the old company was dissolved in 1935, he was appointed general superintendent of refineries of The Ohio and was named manager of the Refining division in 1947.

What's **Happening** . . .

J. E. Sherborne, Morris Muskat, C. L. Moody and L. Laskaris.

Group Session, Public Relations. Public Relations Session, Stanton K. Smith, Smith Oil and Refining Company, "The Myth of Monopoly," H. S. M. Burns, Shell Oil Company; Presentation of OIC "Certificate of Appreciation," Smith; Showing of film "It's Your Move."

Tuesday, November 10—Group Session, Financial and Accounting. Financial and Accounting Session, Donald P. Jones, Sun Oil Company. Addresses: Jones; Richard Heflebower, economist, Northwestern University; G. W. Welsch, Lybrand, Ross and Brothers and Montgomery; and Reese H. Taylor, Union Oil Company of California. Presentation of API "Certificate of Appreciation," Jones.

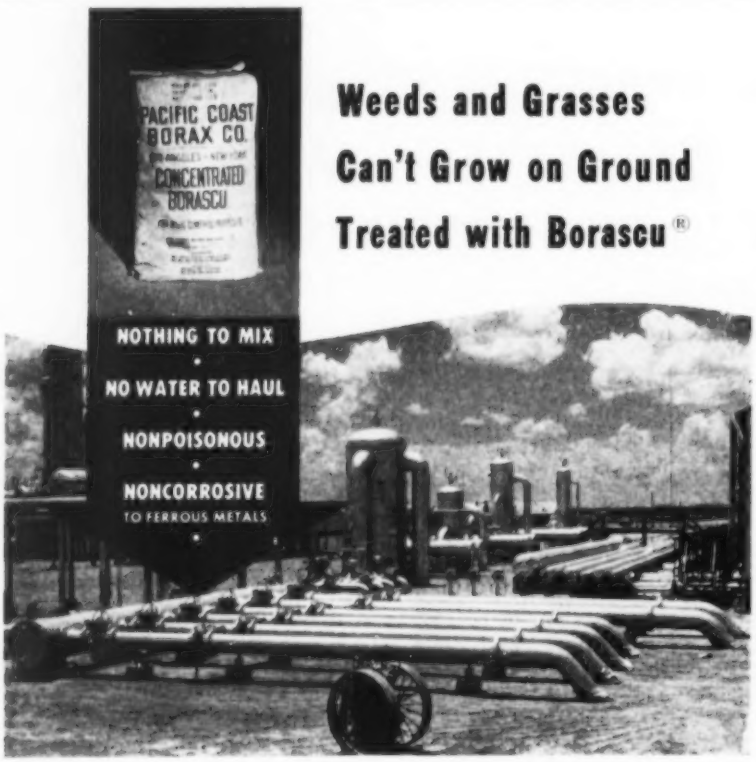
Division of Refining committee meetings. Committee on Refinery Equipment, W. H. Creel. Smoke and Fumes Committee, W. L. Stewart, Jr. General Committee, John W. Newton. Subcommittee on Electrical Equipment, L. M. Goldsmith. Joint Meeting; Subcommittee on Pump Manuals, J. J. Stadtherr; Manufacturers' Subcommittee on Pump Manuals, G. V. Shaw; with Stadtherr presiding.

Wednesday, November 11—General Session, L. S. Wescoat. Addresses: Frank M. Porter; John J. McCloy, The Chase National Bank; Hon. Johnston Murray.

Group Session, Safety and Fire Protection. Symposium on Tank-Truck Loading, B. G. Crane, E. I. duPont de Nemours & Company. Open Forum.

Group Session, Lubrication Session. Lubrication Session, G. T. Dougherty, Standard Oil Company (Indiana). Address: C. A. Chayne, vice president in charge of engineering, General Motors Corporation; Address: J. E. Dyer, vice president for marketing, Sinclair Refining Company.

Thursday, November 12—General Session, L. S. Wescoat. Addresses: P. C. Spencer; Lewis W. Douglas, The Mutual Life Insurance Company; Hon. Douglas McKay.



Weeds and Grasses Can't Grow on Ground Treated with Borascu®

.....a single application of Borascu Weed Killer may keep an area cleared for 1 or 2 years!

Where ground must be kept bare of all fire-hazardous weeds and grasses . . . that's the place for BORASCU! This weed killer gives long-lasting results because it goes into the soil, and remains there, where it can destroy plant life, *roots included!* Economy-minded production men like BORASCU; figure it saves up to 80% of former "grassing" costs . . . and it's safe, nonflammable, easy to use. Write for literature.

DISTRIBUTORS LOCATED THROUGHOUT OIL FIELDS OF U.S.A., CANADA, MEXICO, COLOMBIA, VENEZUELA

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

630 SHATTO PLACE • LOS ANGELES 5, CALIFORNIA

Siegel Will Direct Affairs of Socony-Vacuum in Middle East

Robert Siegel, president of Socony-Vacuum Overseas Supply Company, has been elected a director and executive in charge of Middle East Affairs of Socony-Vacuum Oil Company, Inc. He fills a vacancy left by the recent death of Charles L. Harding.

Siegel's first job with Socony-Vacuum was in the Distribution department, where he served as an office boy, then as a clerk, and later in other capacities. He was promoted to a succession of responsible positions, and, in 1946, became president of Socony-Vacuum Oil Company of Venezuela. Three years later he was appointed manager of the Foreign Producing department, serving in that capacity until 1951, when he became president of Socony-Vacuum Overseas Supply.

Phillips 30th Corporation To Amass Billion Dollar Assets

An announcement from Bartlesville, Okla., reveals that 36-year-old Phillips Petroleum Company recently became the 30th corporation in American industry with total assets in excess of one billion dollars. Phillips' 36-year stretch to the billion dollar level is the shortest time required by any oil company not having predecessor companies with large, integrated operations, officials said. Next to the youngest of the 20 largest oil companies, "Phillips has grown faster than any of them and faster than any other billion dollar company in the last ten years, when assets increased nearly fourfold," they declared. In the past five years alone, the company has more than doubled its size.

K. S. Adams, who became president of Phillips in 1938, is now board chairman and chief executive officer.

Sohio's Hughes Made Chairman Of Gordon Research Comittee

Everett C. Hughes, chief of the Chemical and Physical Research division of The Standard Oil Company (Ohio), has been named chairman of the management committee for the Gordon Research Conferences for this year.

These conferences consist of one-week meetings, each on a special subject of chemical or biological interest. There were 24 of these conferences during the past summer, and there will probably be around 30 next year, according to Dr. Hughes.

The Gordon Research Conferences of the American Association for the Advancement of Science are held at Colby Junior College and the New Hampton School for Boys in New Hampshire.

Tide Water Associated Elects Rogers to Executive Position

R. D. Rogers has been appointed a vice president of Tide Water Associated Oil Company, and vice chairman of the Operating Committee, Eastern division.

Rogers, recently appointed manager of the Transportation and Supply department, Eastern division, with headquarters in New York City, has been in the service of Tide Water Associated and its predecessor companies for more than 30 years. He has had wide experience in the Refining and Sales departments of the Eastern division.

Kimball Named by Sinclair as General Manager of Refineries

Sinclair Refining Company has announced the appointment of Thomas B. Kimball as general manager of refineries. He succeeds John W. Duckett, who is retiring after 35 years of service with the Sinclair organization.

Kimball

Kimball joined Sinclair in 1930 in the Research and Development department at East Chicago, Ind. Before being transferred to the New York office in 1943, he was in charge of the Cracking division and of the process engineering and development of light oil processes at the East Chicago plant. He was appointed assistant manager of refineries in 1950 and held that position until his recent appointment.

Batzell Urges Controls as Way To Needed Reserve Capacity

If the government hopes to build the petroleum reserves it needs for emergencies, it must take such action as voluntary agreements, Elmer Batzell, counsel for the Independent Refiners Association of America, has told Interior Secretary McKay in a recent letter.

Batzell contended that no adequate reserve now exists, and that none can be expected unless some government-industry action is taken to "protect" idle capacity. When any company builds new facilities, he argued, it must use those facilities to the maximum to get a return on its investment. Therefore, he explained, if facilities are in operation, they cannot be considered as "reserve."

Furthermore, Batzell said, such maximum use of facilities in times when output exceeds demands simply means that someone is going to be forced out of business, and this, in turn, reduces "reserve capacity" which the government desires. He said that independent refiners are in "desperate plight" and urged that government action be taken soon. He asked for an "opportunity" to discuss the matter with McKay in greater detail.

Thacher Made Vice President Of California Research

John H. Thacher has been elected a vice president of California Research Corporation. Thacher, a petroleum engineer and geologist, has been with Standard since 1930, serving in many varied capacities in the field of oil and natural gas production. For the past three years he has been executive assistant to the vice president, specializing in problems connected with the Naval Petroleum Reserve at Elk Hills.

During the war Thacher worked in Washington with the WPB and PAW, where he served as executive secretary and as special assistant to the deputy administrator.

Thacher will take over direction of the oil field research program now headed by E. G. Gaylord, who retired October 1.

Pan American Refining Renews Fellowships; Sets Up Another

Five fellowships for the academic year 1953-54 have been renewed by Pan American Refining Corporation, which has also established a new fellowship. Grants were renewed at the University of Illinois, Massachusetts Institute of Technology, Rice Institute, University of Texas, and University of Kansas. The new fellowship was granted to the University of Arkansas. The six fellowships are available to graduate students taking advance work in chemistry or chemical engineering.

Fellows appointed to use the Pan American grants are: Elmer L. Dougherty, University of Illinois; John E. Anderson, M.I.T.; Arthur R. Price, Rice Institute; Joe G. Henrickson, University of Texas; and Thomas A. Milne, University of Kansas. Since the University of Arkansas only recently accepted the fellowship, a fellow has not yet been named.

What's **Happening** . . .

Gets Three Safety Awards

Three "million hour" safety awards have been presented to General Petroleum Corporation by the American Petroleum Institute.

General Petroleum's Torrance refinery has won an award for 1,284,553 man hours worked without a disabling injury. The company's Engineering department had built up a total of 1,038,818

Can you afford to be without corrosion-resistant thermometers?

Production errors caused by thermometer failures can be mighty costly.

The corrosion-resistant, pressure-tight construction of Rochester dial thermometers protects you from this sort of expensive trouble. And it practically doubles the life of the thermometer under severe operating conditions.

An exclusive stainless steel welding process bonds the case, stem and nut into a single corrosion-resistant unit.

RECALIBRATE ON THE JOB

Rochester dial thermometers are built to stay accurate under rough treatment. But if an unusually hard blow knocks the pointer out of adjustment, you can recalibrate it quickly and easily by turning a single screw.

You can order money-saving Rochester thermometers from one of our specialized instrument representatives, listed in Sweet's Catalog or the yellow pages of your telephone directory. Or just mail the handy coupon for full details.

MILLIONS of Rochester dial thermometers are now delivering dependable service

Rochester

DIAL THERMOMETERS
GAUGES
AMMETERS

Rochester Manufacturing Co., Inc.
38 Rockwood Street, Rochester 10, N. Y.

Send me complete information on Rochester corrosion-resistant dial thermometers.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

man hours to earn its citation. The third award went to the company's Oregon Marketing division.

Gonzalez Succeeds Harris As Treasurer of Humble Oil

Richard J. Gonzalez, director in charge of economics and statistics at Humble Oil & Refining Company, has been elected treasurer. He succeeds David B. Harris, resigned. Gonzalez, who joined the company in 1937, has been a member of Humble's board of directors since 1951. Through the years he has been engaged in economic and financial matters with which the company was concerned.

Dow Appoints Evans Head of Firm's Industrial Relations

Luther Evans, formerly in charge of industrial relations for The Dow Chemical Company's Texas Division, has been appointed to the newly created position of director of industrial relations for all Dow operations, with headquarters in Midland, Mich.

Evans will supervise and coordinate all Dow employe activities and will be in active charge of salary and wage administration, employe benefits, safety and medical work, training programs and labor relations for the company.

Evans recently was elected to the board of directors of Dowell Incorporated, Dow subsidiary.

A Shell Photograph

Kenyon provide a *complete* thermal insulation service to the oil industry, including technical advice on thermal insulation specifications, and finishes for all conditions. Supply of materials, application, supervision, on sites throughout the world. The photograph shows columns on the Distillation Unit. M.E.C. project at Ellesmere Port, Cheshire.

Call in KENYON to keep the heat in!

WM. KENYON & SONS (AMERICA) LTD., PERTH AMBOY, N.J., U.S.A.

WILLIAM KENYON & SONS LTD., DUKINFIELD, CHESHIRE, ENGLAND

KH 132

National Science Foundation Offers Science Fellowships

More than 700 students with special abilities in science will be selected for a year of graduate scientific study during the academic year of 1954-55 in the National Science Foundation's Third Annual Graduate Fellowship Program. The closing dates for receipt of applications are December 15, 1953, for postdoctoral applicants and January 4, 1954, for graduate students working towards advanced degrees in science. The selections will be anounced on or before April 1, 1954.

National Science Foundation fellowships are awarded to American citizens who will begin or continue their studies at the graduate level in mathematical, physical, biological, medical and engineering sciences during the 1954-55 academic year.

Selections will be made solely on the basis of ability, the Foundation reports. The majority of fellowships will go to graduate students seeking masters or doctors degrees in science, although a limited number of awards will be made to postdoctoral applicants. Graduating college seniors in the sciences who desire to enter graduate school are encouraged to apply for the awards.

National Science Foundation graduate fellows may attend any accredited nonprofit institution of higher education in the U. S. or similar institutions abroad. Applications for the 1954-55 National Science Foundation Fellowship Program may be obtained from the Fellowship Office, National Research Council, Washington 25, D. C.

Jefferson Completes Second Major Addition at Austin

Jefferson Chemical Company, Inc., has completed a major addition to its research laboratories at Austin, Texas. The new facilities, comprising two air-conditioned, interconnected brick and concrete buildings, provide upwards of 25,000 square feet of additional floor space. The smaller of the two buildings houses the library and administrative offices, and the other contains fully-equipped laboratories to accommodate about fifty research chemists and assisting technicians.

The new laboratories constitute the second major addition by Jefferson at Austin since its establishment in 1949 and will permit accelerated growth of the company's research and development activities, and "is a necessary outcome of its entry into new fields of chemistry." It is expected that a number of new products presently being market-tested will shortly make their way into commercial production.

University of California Prof Gets Belgium Fulbright Award

Theodore Vermeulen, professor of chemical engineering at the University of California, has received a Fulbright Award for Belgium, and will lecture on plant design at the universities at Liege and Ghent during the current academic year. While in Europe he will also participate in the research program of the Institute of Petroleum in Paris, where he will work especially on the phase-equilibrium relations and apparatus requirements for solvent extraction of lubricating oils.

ODM Seeking to End Tax Aid For Lube and TEL Facilities

Rapid tax amortization privileges for new lubricating oil and tetraethyl lead facilities will end if Office of Defense Mobilization's proposed new expansion goals for the petroleum industry are adopted. ODM submitted the proposed goals to Petroleum Administration for Defense to serve as a guide to the latter agency in recommending expansion projects for rapid tax amortization.

The program proposed by ODM would end the expansion programs for the two types of facilities September 11. Any new projects in these two fields would not be granted rapid tax write-off privileges unless they were approved prior to the September cut-off date. Chances are that PAD will go along with the proposal since both the lubricating oil and TEL expansion programs are well over the hump in meeting PAD goals. ODM's views were made known after that agency received a letter from PAD advising which PAD expansion goals should be left to stand and which stretched out.

The revised expansion goals include a slightly higher target for basic refinery capacity to be reached during 1955 than had originally been suggested by PAD. The ODM recommended refinery expansion program calls for construction of crude oil refining capacity in excess of 400,000 barrels daily net in each of 1954 and 1955, to reach a total operable capacity of 8,900,000 barrels daily on January 1, 1956. The proposed expansion for 1954 is the same as previously recommended by PAD, but the latter had suggested a target of 8,750,000 barrels daily capacity to be reached by the start of 1956. This would have meant an expansion of only 250,000 barrels daily in new capacity in 1955.

Natural gas liquid processing capacity suggested under the new ODM program is for construction of 120,000 barrels daily of net capacity in each of 1954 and 1955, to reach a total of 1,280,000 barrels daily by January 1, 1956. This was the identical program first suggested by PAD.

ODM recommended that 75,000,000 barrels of new storage capacity be erected annually in 1954 and 1955 to reach a total of 1,360,000,000 barrels by January 1, 1956.

Union Oil Tests Oil Shale For Brazilian Government

Union Oil of California is conducting pilot shale retorting tests for the Brazilian government at Union's Wilmington refinery.

Three hundred tons of Brazilian oil shale will be processed in an experimental retort to determine whether an 8000-barrel-per-day commercial plant near Sao Paulo, Brazil, using Union's retort design, would be feasible. If constructed, this would be the first commercial shale oil plant in the Western Hemisphere.

Among others who witnessed the pilot run were engineers of The M. W. Kellogg Company and Foster Wheeler Corporation, who may install the unit in Brazil.

Preliminary results indicate Union's process can achieve economies and operating advantages with Brazilian shale, which is fragile and has a high water content, officials said.

Egloff Scheduled to Speak to Chemical Society of Japan

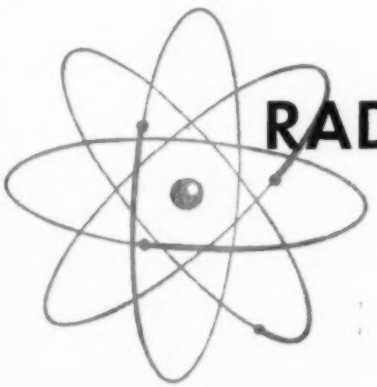
Dr. Gustav Egloff, director of research for Universal Oil Products Company, is slated to play a role in the 75th anniversary celebration of the Chemical Society of Japan. Dr. Egloff will be the only American to address the Society when it meets in Tokyo later this month. As one of three invited foreign lecturers, he will speak on "The Platforming Process" and "Chemicals from Petroleum" at Tokyo, and "Catalytic Reactions in Oil Refining" at Osaka during the week of the celebration.

As representative of the American Chemical Society and of the American Institute of Chemists, Dr. Egloff will present congratulations from the organizations in the form of honor scrolls at a special ceremony.

What's **Happening** . . .

Hanford, Kellogg Executive, Elected Director of Pullman

Dr. W. E. Hanford, vice president in charge of research and development at The M. W. Kellogg Company, has been elected a director of Pullman Inc., of which Kellogg is a subsidiary. Hanford, prominent in many fields of research, is noted for his work in synthetic or-



RADIOACTIVITY

SOURCES • SERVICES
CHEMICALS • RESEARCH
INSTRUMENTS

Tracerlab offers the oil industry the most fully developed line of nuclear instruments, accessories, sources and radiochemicals available today. Regardless of what you need — a Geiger tube, special source, or the design and construction of a complete survey rig — Tracerlab can fill your requirements.

If you have any interest in radioactivity, present or potential . . . you'll want a copy of our 16-page booklet "Radioactivity and the Petroleum Industry", a survey of most of the known oil industry applications. Other valuable informative literature is also listed below.

Tracerlab INC.
130 HIGH ST., BOSTON
2295 SAN PABLO AVE., BERKELEY

WASHINGTON • NEW YORK • HOUSTON • ATLANTA
LOS ANGELES • PARIS • CHICAGO • CLEVELAND

Please send me free copies of the Tracerlab literature checked.

( ) Radioactivity and the Petroleum Industry
( ) 108-page instrument and isotope catalog
( ) Radioactivity Consulting
( ) Co-60 and Ir-192 Radiography Sources
( ) Sample copy of TRACERLOG, external technical publication

• NAME
• TITLE
• COMPANY
• STREET
• CITY
• ZONE STATE

What's **Happening** . . .

ganic chemistry. He joined Kellogg in 1945, advancing to vice president after only one month. Before joining Kellogg he served as a research chemist with E. I. du Pont de Nemours & Company, and as director of research with General Aniline & Film Corporation.

1954 Foreign Lube Oil Output To Be 53,100 Barrels Daily

Free-world refiners outside the U. S. plan production of an average of 53,100 barrels a day of lubricating oils during 1954, Acting Deputy Petroleum Administrator Rea Jackson has said. That output would represent almost a 60 percent increase over the actual production of 33,200 barrels a day during 1952.

Figures on prospective production were gathered during a recent survey by PAD on planned refinery expansion abroad. The agency asked for statistics on production of lube oils rather than capacity because it believes the figures give a clearer picture of probable free-world developments, Jackson said.

A less-detailed survey by PAD in 1952 indicated that refiners abroad plan a lube-oil capacity of 75,000 barrels a day by 1955. The total capacity would be used, though, only if demands and economics justified it.

The PAD survey showed:

Total lube oil production of the Western Hemisphere in 1952, was 11,400 barrels a day; expected 1954 production: 17,700 barrels a day. (These figures cover all free-world countries except the U. S.) Total lube oil production of the Eastern Hemisphere in 1952 was 21,800 barrels a day; expected 1954 production: 35,400 barrels a day.

Henning Becomes Manager of California Standard Refinery

L. L. Henning has been named manager of the Bakersfield, Calif., refinery of Standard Oil Company of California, succeeding M. M. Moore, retired.

Moore, head of the Bakersfield plant for the past ten years, joined Standard in 1913. He began as a chemist in the company's El Segundo refinery and later served in managerial capacities at both El Segundo and Richmond refineries.

Henning, previously superintendent of the Richmond, Calif., refinery Chemical division, has been with Standard since 1934. He started in the company's General Engineering department and for the past 12 years has been in the Cracking division at Richmond.

ERRATA

In Professor M. G. Larian's article "How Many Operating Variables Can You Control?", September REFINER, pages 219-223, the following corrections are indicated: In Figure 4, page 222, the horizontal stream from the reactor, extreme upper right, should have been labeled "Overhead Product (Superheated Vapor) D, Y_{AD}, Y_{BD}, π_{VD}, t_{VD} H_D.

Likewise, the upper right-hand VERTICAL stream should have been labeled: L_0, X_{A0}, X_{B0}, π_{L0}, t_{L0}, h_0.

Halfway down in column 1, page 223, make it read "and as two variables from this block are fixed independently, all the intensive," etc.

Harger Succeeds Pollard as El Segundo General Manager

D. K. Harger has been named general manager of Standard Oil Company of California's refinery at El Segundo. He succeeds the late C. A. Pollard, who held the position for two years until his death last month.

Harger

Harger, who has been manager of operations at El Segundo since 1946, joined Standard in 1926, after receiving a degree in chemical engineering at Stanford.

Transferring to the manufacturing department in 1934, Harger in 1942 was transferred to the company's refinery at Richmond as superintendent of process control. After several years in Richmond he returned to El Segundo as manager of operations.

Humble Promotes Marshall in Technical Service Division

The promotion of C. H. Marshall to technical specialist has been announced by Technical Service division at Humble Oil & Refining Company's Baytown, Texas, refinery.

As a technical specialist, Marshall will work primarily in the fields of process designs of new installations.

Socony-Vacuum's Harding, 47, Taken by Death at Manhasset

Charles L. Harding, director and vice president in charge of Middle East affairs of Socony-Vacuum Oil Company, Inc., died last month at Manhasset, N. Y. He was 47. He had been a member of Socony-Vacuum board of directors since 1948.

Harding was with Shell Oil Company from 1933 to 1942, first in San Francisco and later in New York, leaving to serve with PAW until 1944. He became a member of Socony-Vacuum's law department on September 1, 1944, but returned to PAW in January 1945, going back with Socony-Vacuum in September of that year. He was elected a vice president and member of the executive committee in January of this year.

Blaw-Knox Division Will Survey Natural Resources of Oklahoma

Oklahoma State Planning and Resources Board has engaged Blaw-Knox Company's Chemical Plants division to conduct a survey of the state's natural resources and market potentialities, and compile the facts for use by the Board. The Board will use the assembled information and conclusions provided by the technical report in conjunction with basic information from other sources, to encourage industries to locate their plants in Oklahoma.

Credit to ASME

The article beginning on page 135, "The Mechanical Design of Fluid Catalytic Hydroforming Units," was originally presented to the Eighth Annual petroleum mechanical engineering conference of the American Society of Mechanical Engineers, Houston, September 28-30, 1953.

PAD Survey Shows Future Rise In Foreign Refining Capacity

Refining capacity in the free-world nations outside the U. S. will be 40 percent greater by the end of 1955 than it was at the end of 1951, Acting Deputy PAD Rea Jackson has said. Refineries in the Far East will have increased their capacities by 77 percent over the period, aand European refineries will have increased their capacities by 47 percent.

Western Hemisphere refiners outside the U. S., however, plan only 28 percent increase in capacities over the period. No major expansion is planned in the Caribbean area, which figures so largely in Western Hemisphere output.

These statistics are available, Jackson said, as a result of a survey of foreign refining capacity recently completed by PAD. Refiners throughout the free world supplied the agency with capacity figures on all projects on which work has actually been begun.

On other data PAD requested comparisons between the end of 1952 and the end of 1955.

The statistics show that foreign refiners plan significant increases in the installation of modern refining processes such as catalytic cracking and even more catalytic reforming.

In the Western Hemisphere, because of projected increases in Canada and Mexico, the refiners plan to use catalytic cracking on what will amount to 10 percent of their total crude run instead of the present 7 percent. In the Eastern Hemisphere, with the greatest advance to be registered in Europe, the refiners plan catalytic cracking for 11 percent instead of the present 7 percent.

Presently foreign refiners are able to use catalytic reforming on only 10,000 barrels a day, the survey reveals, but by the end of 1955 they will be able to reform 127,000 barrels a day. Again it is the Eastern Hemisphere that accounts for the major part of the increase.

Facilities for thermal cracking and reforming also will be expanded over the next several years, the study shows. Because there are planned conversions to the more efficient catalytic processes, though, the percentage on crude that will be thermally cracked or reformed is expected to drop.

Site of Kenya Refinery Work Part of Designated Crown Land

Terms of a bill designed to vest in the crown over 2000 acres of land on the Mombasa mainland have been published by the Kenya government. The land is south of where Anglo-Saxon Petroleum Company is constructing an oil refinery and auxiliary works. Estimated cost of the refinery is $210 million. Within the next 10 years, the government is empowered to grant additional areas for use by the company.

New Brazilian Law Would Make Monopoly of Oil Industry

Brazil's new oil law, approved by congress, has been sent to President Vargas for signature which official sources expect within a few days. Under the bill, refining of national and foreign petroleum, prospecting and development of petroleum deposits, and transportation of Brazil's crude oil and derivatives by pipe line and tanker become a state monopoly.

P-A VENTURI GAS SCRUBBERS

Here's why ONE INSTALLATION leads to another

Repeat business is a sure sign of client satisfaction in any field. That's why the record of repeat installations of Chemico P-A Venturi Scrubbers is impressive. Most Chemico installations currently underway have predecessors in the same company or in the same scrubbing field.

Multiple installations are presently in service scrubbing sulfuric and phosphoric acid mists, metallurgical dusts and many other of the *more difficult* fumes encountered in the chemical industry.

If you have a serious air pollution or waste recovery problem not in our experience file, we will be glad to send one of our experienced engineers to make reliable pilot tests at your plant with our portable equipment.

1. *Low capital cost*

WHY are capital costs low?
Because of simplicity of design.

2. *Low maintenance expense*

WHY are maintenance costs low?
Because there are no complex accessories required to maintain units at top performance levels.

3. *High collection efficiency*

WHY are collection efficiencies so high?
Because the patented feature of the P-A Venturi induces a high degree of particle agglomeration.

Phone (MU 8-2370) or write our P-A Sales Dept. for further information and ask for our Bulletin M-102 on P-A Gas Scrubbers.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

Technical Representatives Throughout the World • Cables: Chemiconst, New York CC-250

Here's More

Information on Advertised Products

SAVE TIME . . .

By using the free and convenient Reader Service Postcards on opposite page. Circle on the card the identifying key number listed below for each advertisement in this issue on which additional data are desired.

IT'S FAST, CONVENIENT, CERTAIN

A

(A1) The Air Preheater Corp. 52
(A2) Airetool Manufacturing Co. 222
(A3) Alan Wood Steel Co. 174
(A4) Alan Wood Steel Co. 234
(A5) Allis-Chalmers Manufacturing Co. 7
(A6) Allis-Chalmers Manufacturing Co. 9
(A7) Allis-Chalmers Manufacturing Co. 11
(A8) Aluminum Company of America 75
(A9) American Locomotive Co. 66-67
(A10) American Recording Chart Co. 251
(B1) American Sand-Banum Co. 258
(B2) Atlantic Refining Co. 68-69
(B2) Atlas Powder Co. 58
(B3) Austin Brothers Steel Co. 233

B

(B4) The Babcock & Wilcox Co. 28-29
(B5) The Babcock & Wilcox Co. 181
(B6) Badger Manufacturing Co. 179
(B7) Badger Manufacturing Co. 236
(B8) Baldwin-Hill Company 224
(B9) The J. B. Beaird Co. ..... Opp. 64
(B10) The J. B. Beaird Co. ..... Opp. 65
(C1) Blaw-Knox Co. 17
(C2) Blaw-Knox Co. 169
(C3) Blaw-Knox Co. 255
(C4) Bridgeport Brass Co. 171
(C5) Brown & Root, Inc. 94
(C6) Burgess-Manning Company 209

C

(C7) Catawissa Valve & Fittings Co. 177
(C8) The Chapman Valve Mfg. Co. 203
(C9) Chemical Construction Corp. 215
(C10) Chemical Industries Exposition 246
(D1) Chicago-Wilcox Mfg. Co. 258
(D2) Chiksan Company 82
(D3) Childers Manufacturing Co. 10
(D4) Cities Service Co. 195
(D5) Clark Equipment Co. 167
(D6) Cleton Ltd. 253
(D7) The Continental Supply Co. ..... IV Cover
(D8) Crane Company 163
(D9) Croll-Reynolds Co. 242
(D10) Crouse-Hinds Co. 30
(E1) W. H. Curtin & Co. 252

D

(E2) Dean Brothers Pumps Inc. 186
(E3) De Laval Steam Turbine Co. 199
(E4) Dempster Brothers, Inc. 196
(E5) John Dollinger, Jr., Inc. 250
(E6) Dowell Inc. 192
(E7) E. I. du Pont de Nemours & Co. 90
(E8) E. I. du Pont de Nemours & Co. ..... Insert 168-169
(E9) The Duralov Co. 230
(E10) Durametallic Corp. 238

E

(F1) The Eagle-Picher Co. 200
(F2) Elliott Company 53
(F3) Elliott Company 161
(F4) Engineering Corporation of America 254

F

(F5) Farris Engineering Corp. 78
(F6) Fenwal, Inc. 225
(F7) Filtrol Corp. 229
(F8) Fischer & Porter Co. ..... Opp. 32
(F9) Flexonics Corp. 182
(F10) Foster Wheeler Corp. 227
(G1) The Foxboro Company 62
(G2) Fractionating Towers, Inc. 250

G

(G3) General Electric Co. 76-77
(G4) A. P. Green Fire Brick Co. 81
(G5) Grinnell Company 13
(G6) Gunite Concrete and Construction Co. 259

H

(G7) Hartzell Propeller Fan Co. 264
(G8) Howe-Baker Corp. ..... Opp. 96
(G9) Hudson Engineering Corp. 184-185
(G10) Hydrocarbon Research, Inc. ..... Opp. 33

I

(H1) Ingersoll-Rand Co. 49
(H2) Insul-Mastic Corp. of America 19
(H3) The International Nickel Co. 166

J

(H4) The C. O. Jelliff Mfg. Co. 242
(H5) Jet-Lube Inc. 252
(H6) Johns-Manville Corp. 175

K

(H7) Keasbey & Mattison Co. 247
(H8) The M. W. Kellogg Co. ..... Insert 232-233
(H9) The C. M. Kemp Mfg. Co. 56
(H10) Wm. Kenyon & Sons, Ltd. 212
(I1) Kinney Manufacturing Co. 255
(I2) Koch Engineering Co. 72
(J3) Koppers Company 178

L

(I4) Larkin Packer Co. 241
(I5) Layne & Bowler, Inc. 25
(I6) Leeds & Northrup Co. 8
(I7) Warner Lewis Co. 253
(I8) Lubbock Machine & Supply Co., Inc. 180
(J9) The Lummus Co. 80

M

(J10) Manning, Maxwell & Moore, Inc. 188
(K1) Manzel Division of Frontier Industries, Inc. 226
(K2) Mason-Neilan Regulator Co. 34-35
(K3) The Master Electric Co. 40
(K4) Arthur G. McKee & Co. 165
(K5) Metal Goods Corp. 50
(K6) Milton Roy Co. 45
(K7) Mine Safety Appliances Co. ..... Opp. 97
(K8) Minneapolis-Honeywell Regulator Co. 36-37
(K9) Minneapolis-Honeywell Regulator Co. 84-85
(K10) Minneapolis-Honeywell Regulator Co. 245
(L1) Mission Manufacturing Co. 57
(L2) Mixing Equipment Co. 88
(L3) Murray Iron Works Co. 184

N

(L4) Nagle Pumps, Inc. 238
(L5) National Airoil Burner Co. 254
(L6) National Can Corp. 46
(L7) Natural Gas Equipment, Inc. 168
(L8) Newport News Shipbuilding & Dry Dock Co. 61
(L9) The New York Air Brake Co. 83
(L10) Niagara Filter Division American Machine & Metals, Inc. 65
(M1) W. H. Nicholson & Co. 54
(M2) Norton Company 20-21

O

(M3) Oakite Products, Inc. 235
(M4) Orbit Valve Co. 237

P

(M5) Pacific Coast Borax Co. 210
(M6) Pacific Tube Co. 5
(M7) Page Steel & Wire Division American Chain & Cable Co. 248
(M8) Palmer Thermometers, Inc. 243
(M9) The Patterson Foundry & Machine Co. 249
(M10) Peerless Pump Division Food Machinery & Chemical Corp. 12
(N1) Perco Division Phillips Petroleum Co. 24
(N2) Petro-Chem Development Co. 51
(N3) Petroleum Refiner 231
(N4) Philadelphia Gear Works, Inc. 4
(N5) Platecoil Division Tranter Manufacturing Co., Inc. 256
(N6) The Wm. Powell Co. 23
(N7) The Pressed Steel Co. 32
(N8) J. F. Pritchard & Co. 252
(N9) J. F. Pritchard & Co. 263
(N10) Procon Incorporated 38-39
(P1) Pyrene Manufacturing Co. 185

Q

(P2) The Quaker Oats Co. 55

R

(P3) Reading-Pratt & Cady Division American Chain & Cable Co. 257
(P5) The Refinery Engineering Co. 42
(P6) Refinery Supply Co. 232
(P7) Republic Steel Corp. 73
(P8) Revere Copper and Brass Inc. 159
(P9) The Ridge Tool Co. 172
(P10) The Ridge Tool Co. 260
(Q1) Rochester Manufacturing Co. 211
(Q2) Rockwell Manufacturing Co. 26-27
(Q3) Rockwood Sprinkler Co. 31
(Q4) Rockwood Sprinkler Co. 207
(Q5) Roots-Connersville Blower Corp. 183

S

(Q6) Sawyer-Jensen-Ross Co. 246
(Q7) Schield Bantam Co. 221
(Q8) Schutte & Koerting Co. 41
(Q9) Scovill Manufacturing Co. 60
(Q10) Shell Oil Company 223
(R1) Sims Pump Valve Co. 242
(R2) Southern Engine & Pump Co. 235
(R3) Sparkler Manufacturing Co. 240
(R4) Spring Packing Corp. 63
(R5) Stratford Engineering Corp. 74
(R6) Struthers Wells Corp. 86
(R7) Sun Shipbuilding & Dry Dock Co. 191

T

(R8) Taylor Instrument Companies 18
(R9) The Terry Steam Turbine Co. 48
(R10) Texas Employers Insurance Assoc. 43
(S1) Thermo Electric Co. 64
(S2) The Timken Roller Bearing Co. 6
(S3) Tracerlab Inc. 213

U

(S4) United States Gasket Co. 219
(S5) United States Rubber Co. 70-71
(S6) Universal Atlas Cement Co. 218

V

(S7) Vernon Tool Co. 235
(S8) Henry Vogt Machine Co. 44
(S9) J. H. H. Voss Co. 170

W

(S10) W-K-M Company 173
(T1) Walworth Company 47
(T2) Warren Petroleum Corp. ..... I Cover
(T3) Watson-Stillman Fittings Division H. K. Porter Co., Inc. 87
(T4) Weston Electrical Instrument Corp. 220
(T5) Whitmor Homebuilders, Inc. 22
(T6) Wolverine Tube Division Calumet & Hecla, Inc. 79
(T7) Worthington Corp. 14
(T8) Worthington Corp. 15
(T9) Worthington Corp. 16
(T10) Wyatt Metal & Boiler Works ..... III Cover

Y

(U1) Yarnall-Waring Co. ..... II Cover
(U2) Otto H. York Co. 176

Z

(U3) Zallea Brothers 59

What's New in Manufacturers' Literature

For copies of the catalogs and new equipment literature listed, use one of the convenient Reader Service Postcards on this page. Just circle the number on the card corresponding to the number of the item in which you are interested.

Weld Strength Calculator

A unique weld strength calculator has been made available by Lukens Steel Company for the convenience of designers, engineers and others interested in steel plate fabrication.

A companion tool to Lukens' plate size selector, the weld strength calculator is a durably made plastic slide rule that indicates both the size of weld required for a given applied load, and the weight of a given length of weld in pounds. The calculator gives values for stresses ranging from 2000 to 20,000 psi, and applied loads of from 9000 to 450,000 pounds.

On the reverse side of this pocket-size calculator, basic design data for welded connections is graphically shown, and formulas for calculating nominal properties of welded connections are listed in convenient form. For rapid calculations of your welding problems, get this new aid now, simply . . .

Circle No. 1 on Postcard

Strain Gages

A new price list covering SR-4 strain gages, instruments, and accessories has been announced by Baldwin-Lima-Hamilton Corporation. Specifications for more than 100 sizes and types of gages are given as well as selection considerations for SR-4 gages. Prices and other data on cements and waterproofing equipment are also included. For your copy of this bulletin simply . . .

Circle No. 2 on Postcard

Analytical Service

The Consolidated Engineering Company has established its Analytical Service department as a new service to those in industry who are faced with problems solvable only by use of mass spectrographic methods. Available on a per-analysis basis is a permanently staffed laboratory equipped with the latest CEC instruments. All sample runs, analyses, tests and computations are made by personnel having wide experience of both chemical and specialized analytical fields. Both Western Union and TWX installations speed reports of urgently needed analyses. Precise analyses can be made on virtually any organic or inorganic gas or liquid mixture for as many as 20 unknown substances with molecular weights up to 300. Trace and purity determinations for 0.001 mole percent can also be made. For rapid solution of simultaneous linear equations, such as those resulting from mass spectrometer or infrared analyses, a model 30-103 CEC Computer is available. For complete information on this new service, just . . .

Circle No. 3 on Postcard

USE THESE CARDS,
To Get
COPIES OF CATALOGS
And for More
Information on
NEW EQUIPMENT
ADVERTISED PRODUCTS

EASY TO USE

Circle on one of the cards at right the identifying numbers of each new equipment and catalog item or advertised product on which you want more information. Print your name and address plainly. Tear out and mail card. That's all there is to it. No postage is required if card is mailed in U. S. A. Your request will be forwarded promptly to the company concerned, and the reply will come direct to you.

Postage Will be Paid by Gulf Publishing Company

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 7 (Sec. 34.9, P. L. & R.), Houston, Texas

PETROLEUM
REFINER

BOX 2608

HOUSTON 1, TEXAS, U. S. A.

PETROLEUM REFINER Reader Service Postcard—Oct., 1953, Issue*

EDITORIAL ITEMS—Circle item numbers on which more information desired:

1	4	7	10	13	16	19
2	5	8	11	14	17	20
3	6	9	12	15	18	21

ADVERTISEMENTS—Circle key number of ad for more product information:

A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	P1	Q1	R1	S1	T1	U1	V1
A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	P2	Q2	R2	S2	T2	U2	V2
A3	B3	C3	D3	E3	F3	G3	H3	J3	K3	L3	M3	N3	P3	Q3	R3	S3	T3	U3	V3
A4	B4	C4	D4	E4	F4	G4	H4	J4	K4	L4	M4	N4	P4	Q4	R4	S4	T4	U4	V4
A5	B5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	P5	Q5	R5	S5	T5	U5	V5
A6	B6	C6	D6	E6	F6	G6	H6	J6	K6	L6	M6	N6	P6	Q6	R6	S6	T6	U6	V6
A7	B7	C7	D7	E7	F7	G7	H7	J7	K7	L7	M7	N7	P7	Q7	R7	S7	T7	U7	V7
A8	B8	C8	D8	E8	F8	G8	H8	J8	K8	L8	M8	N8	P8	Q8	R2	S8	T8	U8	V8
A9	B9	C9	D9	E9	F9	G9	H9	J9	K9	L9	M9	N9	P9	Q9	R9	S9	T9	U9	V9
A10	B10	C10	D10	E10	F10	G10	H10	J10	K10	L10	M10	N10	P10	Q10	R10	S10	T10	U10	V10
A11	B11	C11	D11	E11	F11	G11	H11	J11	K11	L11	M11	N11	P11	Q11	R11	S11	T11	U11	V11
A12	B12	C12	D12	E12	F12	G12	H12	J12	K12	L12	M12	N12	P12	Q12	R12	S12	T12	U12	V12

Name (Please Print)_____

Company_____ Position_____

Address_____

MAIL IT NOW . . . *CARD EXPIRES JANUARY 10, 1954

What's New in Manufacturers' Literature

Use one of the free and convenient Reader Service Postcards on this page to request copies of the catalogs in which you are interested.

Flexible Tube Catalog

A new illustrated catalog featuring Chicago Metal Hose and Flexon Expansion Joints is now available from Flexonics Corporation, formerly Chicago Metal Hose Corporation. The catalog presents all basic selection and installation data necessary to the proper application of flexible metal hose and pipe line expansion joints. Complete expansion joint specifications for both low and high units are given in the first section of the catalog. This includes the background engineering facts essential for the selection of the proper joints. Section 2 covers specifications on the basic types of Chicago Metal Hose as well as information on fittings. Your copy of this informative catalog is available now.

Circle No. 4 on Postcard

Flame Cutter

The Vernon-Scardina "Universal" flame cutter, as described in a new catalog issued by Vernon Tool Company, has features which enable it to "set a new standard in the field of flame cutting." According to the bulletin, the self-contained unit saves time, money and welding fittings through reworking, reconditioning and salvaging. The machine incorporates the Vernon unitized cam actuated gas control valve, and an adjustable degree plate permits fittings to be cut at any angle. The speed of the cutter is adjustable while the machine is in operation.

Circle No. 5 on Postcard

Electrical Cables

The Okonite Company has recently published and is now making available a 128-page book entitled "Rubber-Insulated High Voltage Cables Up to 35,000 volts." This new publication contains a great deal of technical information and should be of interest both to the design and field engineer in the petroleum and petrochemical industry.

Of particular interest are the 29 pages of detailed drawings and instructions for splicing and terminating high voltage rubber insulated cables. Based on more than 25 years of service experience, this book should be a must for your technical information file. Your free copy is available now, simply . . .

Circle No. 6 on Postcard

Ceramic Plungers

Ceramic plungers for reciprocating pumps are the subject of a new bulletin being offered by Worthington Corporation.

Referred to as bulletin No. W-404-B5, it lists the chemical and physical properties of the plungers and describes the process by which they are manufactured. The plungers are described as extremely corrosive and abrasive resistant and possessing consistant, high-strength properties. They are available on new pumps and are also interchangeable with metallic plungers on units now in service.

The bulletin also includes a section on recommended procedures for installation of the ceramic plungers.

Circle No. 7 on Postcard

Instrument Catalog

Bailey Meter Company has made available a new catalog describing its complete line of instruments. This catalog is written for the process engineer and offers ranges, basic specifications and detailed literature references on all of Bailey's indicators, controllers, recorders, and detection devices. To get your copy of this informative catalog, simply . . .

Circle No. 8 on Postcard

PETROLEUM REFINER Reader Service Postcard—Oct., 1953, Issue*

EDITORIAL ITEMS—Circle item numbers on which more information desired:

1	4	7	10	13	16	19
2	5	8	11	14	17	20
3	6	9	12	15	18	21

ADVERTISEMENTS—Circle key number of ad for more product information:

A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	P1	Q1	R1	S1	T1	U1	V1
A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	P2	Q2	R2	S2	T2	U2	V2
A3	B3	C3	D3	E3	F3	G3	H3	J3	K3	L3	M3	N3	P3	Q3	R3	S3	T3	U3	V3
A4	B4	C4	D4	E4	F4	G4	H4	J4	K4	L4	M4	N4	P4	Q4	R4	S4	T4	U4	V4
A5	E5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	P5	Q5	R5	S5	T5	U5	V5
A6	B6	C6	D6	E6	F6	G6	H6	J6	K6	L6	M6	N6	P6	Q6	R6	S6	T6	U6	V6
A7	B7	C7	D7	E7	F7	G7	H7	J7	K7	L7	M7	N7	P7	Q7	R7	S7	T7	U7	V7
A8	B8	C8	D8	E8	F8	G8	H8	J8	K8	L8	M8	N8	P8	Q8	R2	S8	T8	U8	V8
A9	B9	C9	D9	E9	F9	G9	H9	J9	K9	L9	M9	N9	P9	Q9	R9	S9	T9	U9	V9
A10	B10	C10	D10	E10	F10	G10	H10	J10	K10	L10	M10	N10	P10	Q10	R10	S10	T10	U10	V10
A11	B11	C11	D11	E11	F11	G11	H11	J11	K11	L11	M11	N11	P11	Q11	R11	S11	T11	U11	V11
A12	B12	C12	D12	E12	F12	G12	H12	J12	K12	L12	M12	N12	P12	Q12	R12	S12	T12	U12	V12

Name (Please Print)_____

Company_____ Position_____

Address_____

MAIL IT NOW . . . *CARD EXPIRES JANUARY 10, 1954

Postage Will be Paid by Gulf Publishing Company

No Postage Stamp Necessary if Mailed in the United States

BUSINESS REPLY CARD

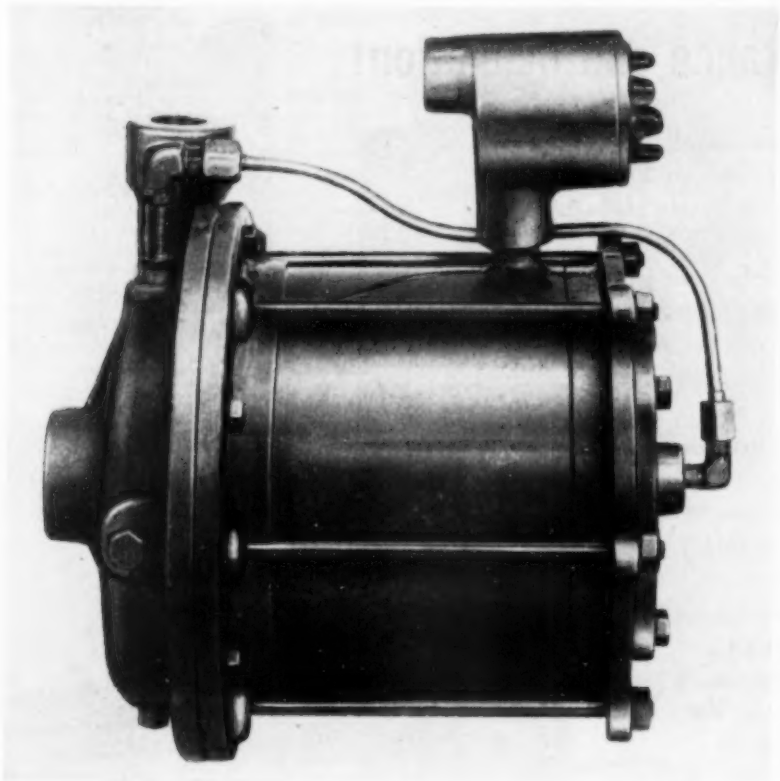
First Class Permit No. 7 (Sec. 34.9, P. L. & R.), Houston, Texas

PETROLEUM
REFINER

BOX 2608

HOUSTON 1, TEXAS, U. S. A.

USE THESE CARDS
To Get
COPIES OF CATALOGS
And for More
Information on
NEW EQUIPMENT
ADVERTISED PRODUCTS



Versatile Chemical Pump

This radically designed centrifugal pump represents a new approach to pump problems by doing away with all mechanical seals.

Chempump Corporation has announced a versatile new fractional horsepower pump for use in the refining and petrochemical industry.

The radically new design of this centrifugal pump makes it a natural for closed vacuum systems as well as for handling toxic, corrosive, inflammable, and other ordinarily troublesome fluids.

The pump design differs from that ordinarily used by making no attempt to keep the fluid being pumped out of the motor housing.

Actually, the pump and motor housings are combined, and a part of the fluid passing through the pump is used as the coolant for the motor. This novel feature is made possible by hermetically enclosing the motor rotor in a nonmagnetic alloy container, and by enclosing the motor stator in a similar material.

At the present time, either Monel or the 300-series stainless steels are available for rotor and stator enclosures. Other materials, such as Carpenter #20 and Hastelloy C will be made available in the future.

Graphitar bearings are normally supplied with the pump, but other materials are available on request.

Because the pump and motor are one integral unit, the necessity of a separate mounting base plate is eliminated. In fact the pump can be mounted directly on major pieces of equipment or it can be "pipe line" mounted.

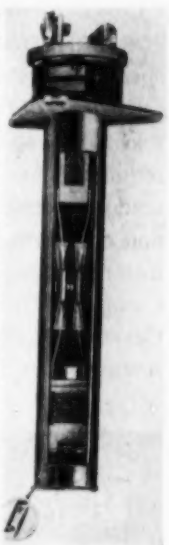
Some of the materials that Chempump has been used to handle during its extensive testing and proving period are:

- Hydrofluoric Acid
- Sodium Hydroxide
- Freons
- Sulfur Dioxide
- Sulfuric Acid
- Liquid Chlorine
- Sodium Plumbite
- Hydrocarbons

Get complete details and engineering specifications on this new development, just . . .

Circle No. 9 on Postcard

Rate-of-Rise **Thermostat**



Fenwal Incorporated has developed a rate of rise thermostat designed to control the rate of heating and to prevent dangerous temperature overshoots. The unit, when used in series with a temperature controller, brings the system up to the control temperature without either overshoot or oscillation around the control point. After the system has been brought up to the control temperature, the standard controller takes over and the rate of rise unit becomes a safety check. The rate-of-rise thermoswitch is adjustable to control the heating rate at any rate between 10 and 100 F. per minute and can be used at any ambient temperature between —100 and 550 F. The outer shell of the unit, which is hermetically sealed, and the exterior electrical connections are made of stainless steel. For complete specifications and details on this new product . . .

Circle No. 10 on Postcard

Steam **Generator**

A complete steam generating plant, the Superior Water-Tube Steam Gerator is designed as a unit, shipped complete and is ready for operation with minimum installation expense. Built on a structural steel base, this unit, designed by Superior Combustion Industries, Inc., requires no brick setting, no pitting, and no special foundation. Refractory, insulation, burner, controls,

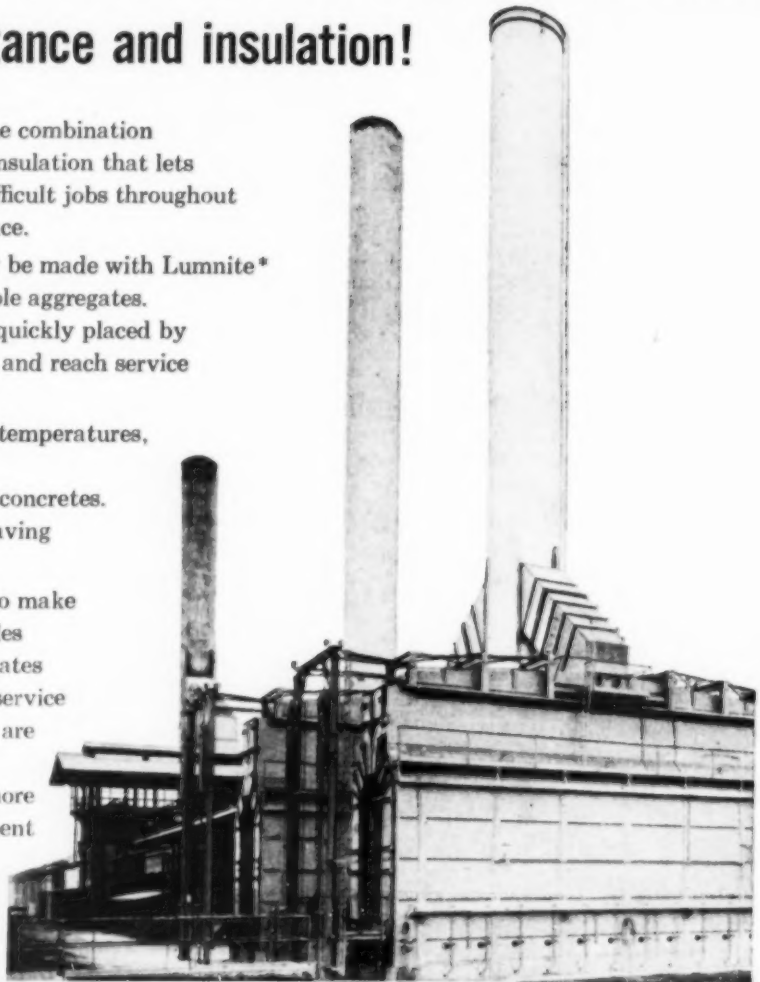
SPECIAL CONCRETES provide economical heat and corrosion resistance and insulation!

SPECIAL CONCRETES provide a unique combination of heat and corrosion resistance *and* insulation that lets you specify one concrete for many difficult jobs throughout the refinery. And they are easy to place.

Special industrial concretes can easily be made with Lumnite* calcium-aluminate cement and suitable aggregates. They help speed construction . . . are quickly placed by cement gun, plastering or pouring . . . and reach service strength in 24 hours or less!

If your problem is soaking heat, high temperatures, corrosion or special insulating needs, chances are you can use these special concretes. They have a proved time- and cost-saving record in many refineries.

FOR CONVENIENCE you may prefer to make special concrete with prepared castables (mixes of Lumnite cement and aggregates selected for specific temperature and service requirements—add only water). They are made by refractory manufacturers and sold through their dealers. For more information write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.



WHERE TO USE SPECIAL CONCRETES

- **Linings of reaction and reforming chambers; fractionating, cracking, rerun, distillation, vaporizing, and alkalization units; bubble, stripper, and flash towers; accumulators and soakers.**
- **In furnaces, heaters and coking ovens.**
- **In ducts, furnace foundations, floors subject to soaking heat.**
- **Stack and flue linings.**
- **Tank linings and pipe linings for protection from sour crude.**

HEATER STACKS such as these utilize special concrete linings for protection against heat and the corrosive effects of condensate. The heaters are lined with refractory concrete, another special type of industrial concrete that assures low-cost, long-service refinery installations at higher temperatures.

**"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

PR-L-80R

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

inter-connecting piping and wiring are complete and installed at the factory.

The unit is designed to provide fully automatic firing with oil, gas or stoker coal and is built in 9 sizes ranging from 5300 to 33,000 pounds of steam per hour and for pressures up to 400 psi.

The unit's "A" type construction promotes quick steaming, while the tube layout protects the steam drum from direct impingement. The large steam drum provides ample steam releasing surface. Internal steam separator assures dry steam delivery. All water wall tubes are fed uniformly through the adequate lower drums. A hydrostatic head assures rapid circulation and immediate response to fluctuating load demands. The unobstructed floor of the firebox makes the design readily adaptable to stoker installation.

Circle No. 11 on Postcard

Pipe Joint Layout

A new tool for quick laying out of pipe joints has been announced by Contour Marker Corporation. It is claimed that with this contour marker the average pipe joint can be marked for cutting in less than five minutes.

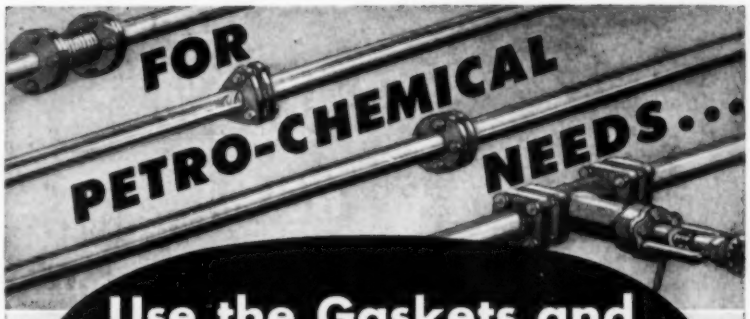
An articulate arm with soapstone point and a dial marked in both degrees and pitch are mounted on a base which is curved to rest on the pipe. When the dial is set to the desired angle, the jointed arm traces the cutting line around the pipe.

This device is intended to speed up pipe layout and to prevent the waste of man hours and cutting gas which occurs in the "cut and try" methods. Two models are available: standard for pipe ranging from 1½ inches to 18 inches in diameter; jumbo from 16 inches to 48 inches in diameter. Instructions for making joints of various angles are included with each instrument.

Circle No. 12 on Postcard

Safe Radioisotopes

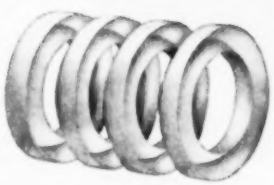
Fisher Scientific Company has made available "safe, inexpensive radioisotopes, bottled and to be sold over the counter or by mail." Users need have neither Atomic Energy Commission authorization, nor formal training at Oak Ridge, nor elaborate safety precautions to obtain any of the 25 different radio-



Use the Gaskets and Packing No Chemicals Can Attack

MADE OF TEFLON ® DuPont Trademark

CHEMISEAL V-RINGS



Select Chemiseal No. 810-V packing for valves. It provides necessary seal at low gland pressures and reduces valve torque because it is extremely anti-hesive. No lubricant is required for superior operation. Supplied in sets to meet specific requirements. Ask for Catalog No. 810-V.

CHEMISEAL PUMP PACKING

Select Chemiseal No. 711 packing for rotating or reciprocating shafts. It provides a low friction 2-way seal that not only prevents axial seepage, but also seals against shaft and stuffing box as well. Write for Catalog No. 711.

CHEMISEAL TEFLON-JACKETED GASKETS

Select Chemiseal No. 1-339 WA Teflon Jacketed Gaskets for all types of metal and special chemical resistant piping connections. Available in any size with a variety of filler materials suitable for stainless steel, glass, glass-lined steel, porcelain, Karbate, Haveg or other chemical piping and equipment. These fillers are protected on both faces and the inside diameter by the chemical resistant Teflon Jacket. Write for Catalog No. 1-339 WA.

UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION
CAMDEN 1, NEW JERSEY

Representatives in Principal Cities Throughout the World

Although WESTON provides sensing elements of various forms for special applications, the element in all standard WESTON Industrial Thermometers is a *multiple helix* as illustrated above. Why the more costly *multiple*, instead of the single, helix? *Just one reason.* WESTON's twenty years experience producing bi-metal thermometers for industry has furnished convincing proof that the shorter, non-sagging *multiple* helix provides better accuracy, over longer periods. And while it provides other advantages, the one thing most thermometer buyers demand is long-term dependability. You get it, in extra measure, in WESTON Thermometers with *multiple* helix. WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

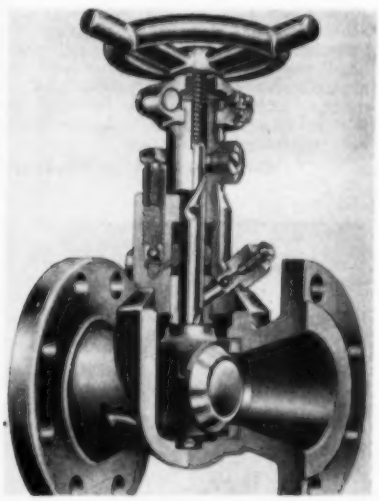
WESTON *Thermometers*

NEW Equipment . . .

active compounds for chemical, medical, pharmaceutical, industrial and educational laboratories.

The new Fisher radioactive reagents are sold in "microcuries"—a thousandth of a millicurie; because of the quantity, no AEC authorization is needed by the user. Each of the radioactive reagents comes in a small screw-capped glass vial whose walls absorb all of the radiation of the contents.

Circle No. 13 on Postcard



Forged Steel Valve

Designed so that there are no voids in its body to trap fluids, Orbit Valve Company's Venturi valve for LP Gas use eliminates vapor leaks by means of a forged steel body and bonnet welded into one, strong pressure vessel. These valves are available with flanged end only; with carbon trim and stainless trim; and with ring joint and raised face. All have maximum ratings of 250 F.

The construction principle pointed to by the manufacturer as outstanding is the valve's adjustable plastic stem packing. The stem packing chamber is backed up by a supply of auxiliary packing as extra protection against leakage along the stem. Valves can be repacked while under pressure in either closed or open position.

The Orbit forged LP Gas valve has rising stems which enable operations men to tell at a glance if the valve is in open or closed position. Its seating principle is both resilient and friction-free in its operation. The seating core rotates to the open or close position. But during the opening or closing cycle, the spherical seating surface of the core face never comes in contact with the valve body or the valve body seat.

This item supplements Orbit Valve Company data on page 814 of The Refinery Catalog, 20th Edition.

Circle No. 14 on Postcard

Dual Gas Analyzer

Analyses of percent oxygen, an index of excess air, and percent combustible gases, an index of fuel-air mixing performance, are offered for the first time in a single, compact unit by the Bailey

Dragline

Clamshell

Shovel

Back Hoe

Magnet Crane

Grapple

Crane

Pile Driver

Backfiller

ANNOUNCING...

SCHIELD Bantam's® BRAND NEW All New

CRANE CARRIER

For use with the Model T-35 BANTAM... the latest development in shovel-cranes.

LIFTS 12,000 LBS.!

LOW PRICED ONLY

$12,750

Complete, as Illustrated F.O.B. Factory

Lower price if Crane Carrier Extras such as double out-riggers and fenders not desired. (Price subject to change)

This brand new Crane Carrier, exclusively engineered for BANTAM mounting by a leading and famous truck manufacturer, answers the demand for all-new truck crane equipment with high-speed mobility. It's built right — and priced right!

This, too, is ALL NEW!

The Great C-35

CRANEWLER

5-ton . . . ⅜ cu. yd.

Yours for only

$10,330

Complete Crawler Back Hoe with 30" bucket, f.o.b. Factory. (Price Subject to Change)

Now . . . BANTAM Offers Any Type of Mounting You Want

The versatile, job-proved BANTAM which has established enviable records of economy on all kinds of lifting and excavating jobs everywhere is now available with a wide choice of mountings, letting you select the best suited combination to handle your jobs faster and at far less cost.

Today, you can get a BANTAM with a brand new, all-new Crane Carrier as illustrated . . . or mounted on a factory guaranteed re-built truck. Or, to save yourself more money, a BANTAM can be field-mounted on YOUR TRUCK.

But, that's not all! Then, to meet your needs for a top quality, low-priced ⅜-yard crawler shovel-crane, Schield BANTAM now offers the new Model C-35 . . . it's the revolutionary crawler everyone's talking about! And, best of all — no matter which type of mounting your work calls for, the complete BANTAM with any one of 9 fast-change front-end attachments is still the lowest priced, ⅜-yard, 6-ton shovel-crane on the market.

Investigate the BANTAM method . . . find out how a BANTAM lets you bid lower and get more work. Ask for a free demonstration on your job. See your nearest Schield BANTAM Distributor or contact the factory, TODAY!

SCHIELD BANTAM CO.
285 Park St., Waverly, Iowa

T-35 with Crane Carrier for fast job-to-job moves

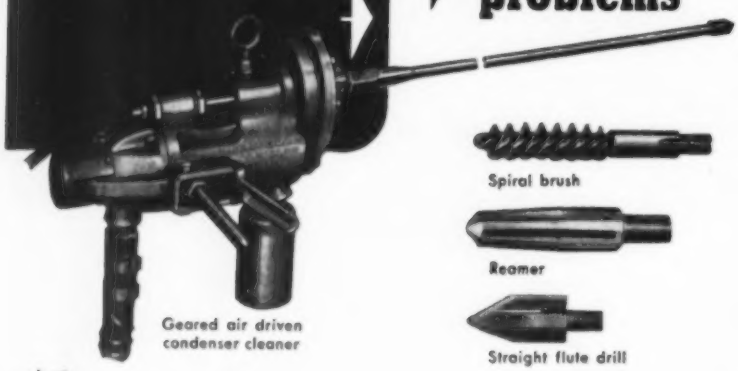
T-35 BANTAM mounts on factory re-built 6 x 6 or on Your Truck.

ANOTHER NEW PRODUCT OF THE SCHIELD Bantam Co.

WORLD'S LARGEST PRODUCERS OF TRUCK-CRANES AND EXCAVATORS

AIRETOOL SOLVES

2 major tube maintenance problems



Geared air driven condenser cleaner

Spiral brush

Reamer

Straight flute drill

CLEANING

Here's the cleaner for heavily scaled small diameter tubes in heat exchangers, condensers. A powerful low speed motor enables the operator to clean without tube injury. A flushing agent is introduced through the motor and drive shaft to keep the drill cool under all scale conditions. Special packing glands prevent leakage. Designed for thorough, safe cleaning of all scale conditions.

EXPANDING

It's new! Rolls tight tube joints automatically by the Retractive Method! Control is set to desired expansion, expander is fully inserted and rolls a short section of the tube. When full expansion is reached, the Expander then automatically retracts, expanding the entire thickness of the tube sheet. This method draws metal toward mouth of tube, prevents elongation, distortion or enlargement of holes, reduces time needed to roll tight joints.

Airetool Automatic Retractive Tube Expansion Control System — for installing tubes in heat exchangers, condensers, boilers.

Write for details about tube cleaning, tube expanding.

BRANCH OFFICES:
New York • Chicago • Philadelphia
Tulsa • Houston • Baton Rouge
Hudson Heights (NJ)

Representatives in principal cities of U. S. A., Canada, Mexico, South America, England.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

THERE'S AN AIRETOOL TUBE EXPANDER OR TUBE CLEANER FOR EVERY TYPE OF TUBULAR CONSTRUCTION.

NEW Equipment . . .

Meter Company. The analyzer which has a minimum range of 0-5 percent and a maximum range of 0-25 percent uses compressed air and hydrogen for catalytic combustion of the sample gas. Noble metal filaments with thermal conductivity compensators are part of the null balance bridges giving the instrument an accuracy of plus or minus 0.25 percent of oxygen and combustibles in the sample. The unit may also be used to automatically control the necessary adjustments required to maintain maximum combustion efficiency within the limitations of the combustion equipment.

This item supplements Bailey Meter Company data on pages 184-185 of the Refinery Catalog, 20th Edition.

Circle No. 15 on Postcard

Portable **Pipe Bender**

For rugged field use, the Wallace Supplies Manufacturing Company now offers to the refining and petrochemical industry a new portable power pipe and tubing bender. This unique tool is powered by a ¾ hp electric drill motor and can handle pipe from ½-inch to 1¼-inch IPS with bends up to 180 degrees. The all steel welded construction of the machine provides for maximum strength and minimum weight. To get the complete information on this time and money saving tool, just . . .

Circle No. 16 on Postcard

Thermocouple Head

Claud S. Gordon Company has designed a new thermocouple head for compactness to eliminate useless bulk and weight. Both the base and cap of the unit are made of malleable iron for extra strength and cadmium plated for

How a military aircraft problem led to

The Greatest Gasoline Development in 31 Years

TCP* is a revolutionary new gasoline additive that stops the greatest cause of power loss in modern automobile engines. TCP additive is now blended into Shell Premium, and is available at Shell stations throughout the United States.

With the advent of high octane number fuels for peak performance of both military and civil aircraft, the problem of spark plug fouling became critical. Maximum design performance and range of the aircraft were severely limited by deposits formed on the insulating portions of the spark plugs. These deposits caused malfunctioning of the spark plug often at critical times when maximum spark plug performance was necessary. The problem was studied jointly by petroleum suppliers, engine and spark plug manufacturers, and airframe builders both from the chemical and mechanical standpoint.

Shell Research Mobilized

To tackle the problem Shell mobilized its research facilities. First step was development of a dependable test for spark plug fouling. With this test, Shell had the necessary equipment with which hundreds of compounds could be quickly tested—rejected and tested again in different formulations. Round-the-clock testing finally led to the discovery of Shell's TCP additive.

Not since the introduction of tetraethyl lead in 1922 has there been such an important development in gasoline.

How TCP additive helps existing engines—can lead to even better designs

This remarkable ingredient actually changes the nature of combustion deposits inside an engine; actually makes them harmless. Plug-shorting and pre-ignition are eliminated. Now car owners get up to 15% more power—often before using the second tankful. Spark plug life is increased as much as 150%, and gasoline mileage is improved.

Car manufacturers and dealers benefit too! New cars perform the way designers intended; new car buyers have few performance complaints. And for the future, designers can plan for higher compression and horsepower, lighter and more compact engine designs.

TCP is Shell's trademark for this additive. It is another example of the progressive research that goes forward day and night in Shell laboratories. It is evidence again that Shell research provides more and better products from petroleum.

*Patent applied for

SHELL OIL COMPANY

SHELL

If you're scanning PETROLEUM REFINER *for help on insulating problems . . .*

HERE'S ONE GOOD ANSWER

BALDWIN-HILL

Mono-Block

There's more to insulation than heat *savings.* Insulation also makes heat easier to *control.* But what type is needed to help produce maximum results? B-H MONO-BLOCK is one good answer because it is effective over the full temperature range to 1700° F. . . . is used on steam boilers, tanks, towers, ovens and similar equipment where accurate control is essential to efficient operation. B-H MONO-BLOCK of fibrous rockwool provides stability under severe temperature and moisture conditions. It is light and easy to handle—and readily cut into straight or irregular shapes for speedy application. If you have any problems involving heat conservation or control—consult our Engineered Insulation Service.

Baldwin-Hill

Clip on signed letterhead and mail

TEAR OUT

BALDWIN-HILL COMPANY, 710 Breunig Ave., Trenton 2, N. J.

Please send complete information on

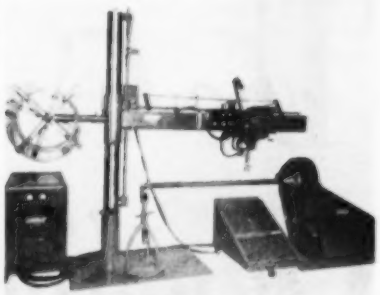
- ☐ MONO-BLOCK . . . Rigid, felted black rockwool block—for high and low temperature use
- ☐ POWERHOUSE CEMENT . . . High adhesion, black rockwool insulating-finishing cement
- ☐ BLANKETS . . . Metal-reinforced, flexible, felted black rockwool insulation
- ☐ NO. 1 INSULATING CEMENT . . . All-purpose, rust-inhibiting plastic cement

NEW Equipment . . .

resistance to corrosion. A new style friction-lock cap can be tightened or removed by a quarter turn. Within the cap is an asbestos gasket to assure a dirt-and-moisture-tight head. The connector block is of a heat-resistant material specially selected to withstand temperatures up to 900 F. in continuous service.

A new improved type of insert simplifies lead wire connections. The design of the "Serv-Rite" thermocouple head permits easy withdrawal of the complete thermocouple element including connector block.

Circle No. 17 on Postcard



Rugged Welding Machine

A new automatic welding machine has been developed by Leader Welding and Manufacturing Company. Called the Model 650 Leader automatic welding machine, the new unit is "ruggedly built for heavy use." It features an all new consolidated finger tip control panel; dual, adjustable, spring-braked rod-reel holders; motorized (20-1 ratio), acme-powered, 8-inch with side beam carriage; a motorized pedestal which is also acme-powered, has a 6-inch push-button-controlled lift and can be rotated through 360 degrees; a heavy-duty, automatic welding head; and an automatic and manual bead lapping control.

All incidental wiring is harnessed to allow three-phase, 220/440 volt, 150/75 ampere connection at point of installation.

Circle No. 18 on Postcard

Unique Tower Packing

Fractionating Towers, Inc. is introducing for petroleum applications its Multi-Path tray packing, a high capacity, high efficiency column internal construction which is suited for installations 12-inch i.d. and larger. Its characteristics include extremely high capacity, low liquid holdup, and low H. E. T. P. values which are virtually independent of the column diameter.

The material is supplied as "trays" which are made up of corrugated sheets of precision expanded metal mesh. When installed in the column the slopes of the corrugations form diamond shaped cells in which the contact between the vapor and liquid takes place. Because of the corrugated structure of the tray, it acts as its own liquid distributor and eliminates the channeling effects which so adversely affect the performance of conventional packings.

The construction is all metallic, and it can be supplied in carbon steel

How would YOU solve these two problems?

1. STORING BULKY FILES. Engineers examine one of 90 compact microfilm rolls that reduce 70,000 drawings, each about 6 square feet in area, for space-saving storage. In a process developed by the Diebold Manufacturing Co. for continuous developing of microfilm, rigid temperature control is essential in the "fixing" tank. Fenwal THERMOSWITCH® unit keeps the "fixing" solution constantly within one degree of the required 100°F.

Photo courtesy of Hotel Statler, Boston

2. KEEPING DISHES SPOTLESS. For this full-time restaurant job, the Statler Hotels and other leading firms serving the public use Colt Autosan Dishwashing Machines. Fenwal THERMOSWITCH devices in these machines have two functions. The first is to control temperature of washing water. Other units act as low temperature cut-off switches — stopping the conveyor belt if water becomes too cold.

3. A FENWAL THERMOSWITCH CONTROL may solve your problems, too. Its external, single-metal shell expands or contracts *instantly* with temperature changes, making or breaking enclosed electrical contacts. Compact, highly resistant to shock and vibration, Fenwal THERMOSWITCH units have solved hundreds of otherwise costly problems.

4. SEND FOR THIS CATALOG for complete explanation of the unique THERMOSWITCH unit. Also ask for more detailed, illustrated discussions of the problems above. Fenwal engineers will be glad to help you solve your temperature control problems involving heat, humidity, radiant heat, pressure and other variables. **Write Fenwal Incorporated, 1010 Pleasant Street, Ashland, Massachusetts.**

Fenwal

THERMOSWITCH®

Electric Temperature Control and Detection Devices

SENSITIVE...but only to heat

Make SURE machinery keeps operating

• For the solution to lubrication difficulties, or chemical feeding problems, more and more companies are turning to Manzel.

...for example:

Chemical Feeders are used throughout the oil industry to keep wells and pipelines in good, flowing condition. *But,* in wet gas fields corrosion frequently stops the motors that power these feeders.

To solve this problem, Manzel developed a chemical feeder with built-in automatic force feed lubrication which protects the gas motor from corrosion and insures continuous operation of the feeder.

For 50 years a leader in the field, Manzel is today a flexible, fast-moving organization with the special technical skill for meeting your needs quickly and economically. Write for further information about Manzel Force Feed Lubricators and Chemical Feeders.

Manzel

285 BABCOCK STREET
BUFFALO 10, N. Y.

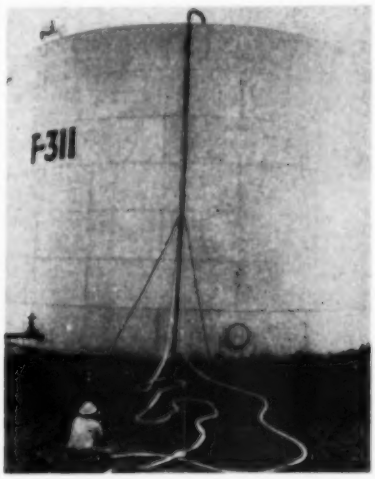
Safeguard high priced machinery with
MANZEL
FORCE FEED LUBRICATION
• Reduce Wear
• Prevent Breakdown
• Slash Oil Consumption
• Insure Round-the-Clock Operation

A DIVISION OF FRONTIER INDUSTRIES, INC.

NEW Equipment . . .

or a wide variety of alloy materials. In new columns, it is installed in sections five to eight feet long but when it is used to replace existing trays, special designs can be worked out to meet specific requirements. Get the details and specifications you need . . .

Circle No. 19 on Postcard



Hydraulic **Foam Tower**

A new portable foam tower, raised and lowered by hydraulic action, is now being offered by National Foam System, Inc. Used in the fighting of fires, the foam tower can be set up in a fraction of the time normally needed, and with one-third the manpower. The same tower may be used for tanks of varying heights, and a simple conversion operation, easily accomplished in the field according to the company, adapts the tower for chemical foam use.

The hydraulic action, which can be applied at a safe distance from the fire, raises the tower to full height in a matter of seconds. When it is elevated to a point above the upper edge of the tank wall, pressure is released and the tower gradually descends until the gooseneck is hooked over the edge of the wall. Foam is then discharged against the inside of the tank wall.

This item supplements National Foam System, Inc., data on page 757 of The Refinery Catalog, 20th Edition.

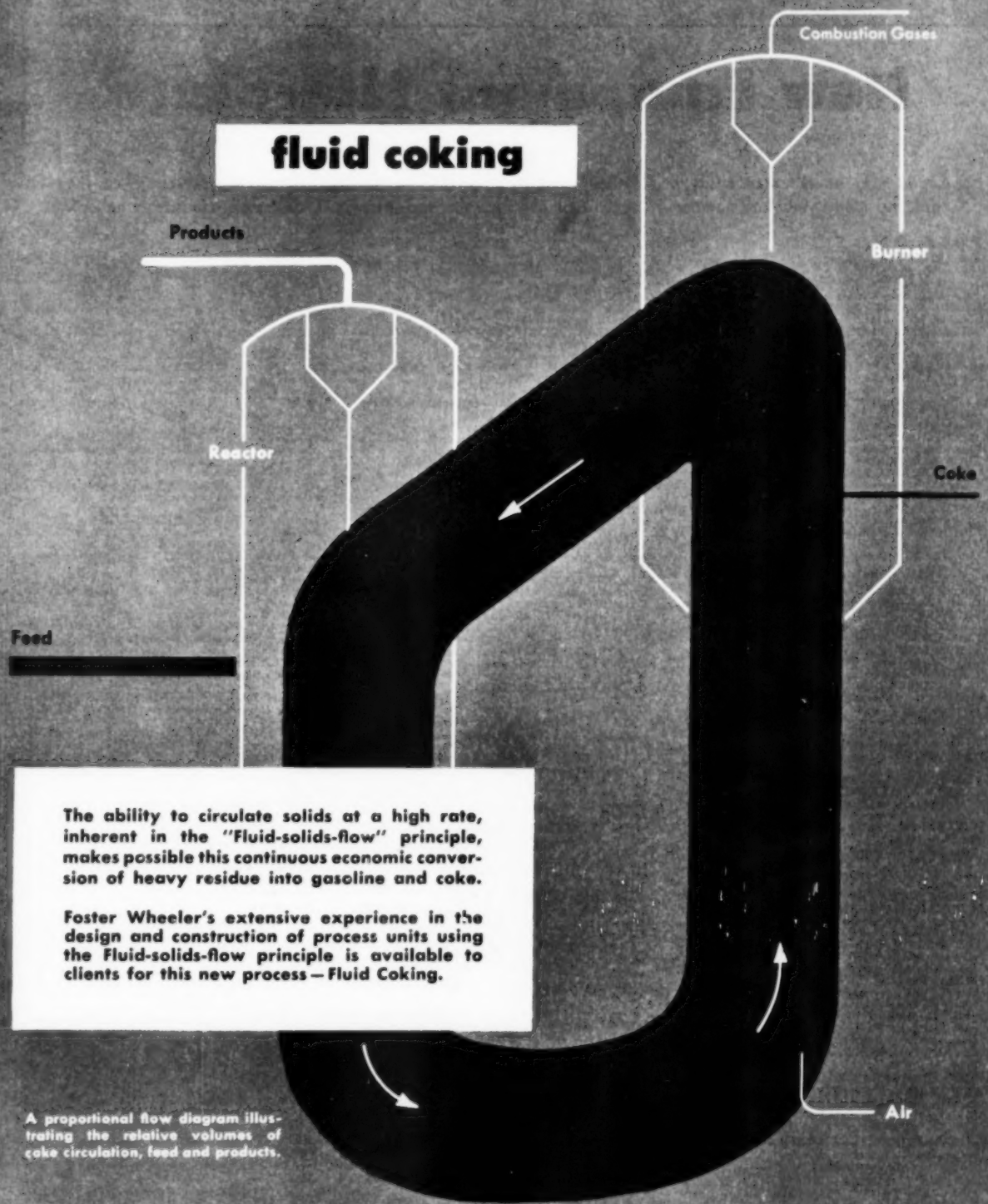
Circle No. 20 on Postcard

Lubricated **Plug Valve**

A new line of lubricated plug valves is being offered to the refining and petrochemical industry by the William Powell Company. This new line features quick and positive shut-off, no exposure of the seating surfaces when the valve is in the open position, and a high degree of precision in manufacture and fitting. It is this precision finishing and the protection of the seating surfaces that allows the lubrication grooves surrounding the ports to provide a positive seal when the valve is closed. These semi-steel and steel lubricated plug valves are available with screwed or bolted glands. Complete engineering data is available on this new line as well as the other types of William Powell Company valves.

Circle No. 21 on Postcard

fluid coking



A proportional flow diagram illustrating the relative volumes of coke circulation, feed and products.

The ability to circulate solids at a high rate, inherent in the "Fluid-solids-flow" principle, makes possible this continuous economic conversion of heavy residue into gasoline and coke.

Foster Wheeler's extensive experience in the design and construction of process units using the Fluid-solids-flow principle is available to clients for this new process — Fluid Coking.

For further information on first cost, utilities, yields, operating economics, design and construction data, write to:

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

New Equipment Literature

Copies may be obtained easily and without cost by using Reader Service Postcard. Just circle on the card the identifying key number of each item in which you are interested. Postcards opposite page 216.

AIR PREHEATERS—Details. The Air Preheater Corp. See page 32.
Circle A1 on postcard.

TUBE CLEANING AND EXPANDING—Details. Airetool Manufacturing Co. See page 222.
Circle A2 on postcard.

ROLLED STEEL FLOOR PLATE—Booklet SD-57. Alan Wood Steel Co. See page 174.
Circle A3 on postcard.

ABRASIVE ROLLED STEEL FLOOR PLATE—Booklet AL-19. Alan Wood Steel Co. See page 234.
Circle A4 on postcard.

WATER CONDITIONING — Bulletin 45. Allis-Chalmers Manufacturing Co. See page 9.
Circle A5 on postcard.

COLLOIDAL CONCENTRATE — Information. American Sand-Banum Co. See page 258.
Circle B1 on postcard.

CATALYTIC REFORMING—Bulletin. Atlantic Refining Co. See pages 68-69.
Circle B2 on postcard.

NON-METALLIC CORROSION INHIBITOR—Information. Atlas Powder Co. See page 58.
Circle B3 on postcard.

PACKAGED COMPRESSOR PLANTS—Information. The J. B. Beaird Co. See page opp. 64.
Circle B9 on postcard.

PULSATION SNUBBERS — Information. Burgess-Manning Co. See page 209.
Circle C6 on postcard.

SWING CHECK VALVES—Catalog 11. Catawissa Valve & Fittings Co. See page 177.
Circle C7 on postcard.

GATE VALVES—Catalog 10. The Chapman Valve Mfg. Co. See page 203.
Circle C8 on postcard.

GAS SCRUBBERS—Bulletin M-102. Chemical Construction Corp. See page 215.
Circle C9 on postcard.

RING GASKETS — Information. Chicago-Wilcox Mfg. Co. See page 258.
Circle D1 on postcard.

SWING JOINTS—Catalog 53-C. Chiksan Company. See page 82.
Circle D2 on postcard.

ALUMINUM JACKETING—Information. Childers Manufacturing Co. See page 10.
Circle D3 on postcard.

FORK TRUCKS—Literature. Clark Equipment Co. See page 167.
Circle D5 on postcard.

REDUCTION UNITS — Manuals G-WBV and G-WWH. De Laval Steam Turbine Co. See page 199.
Circle E3 on postcard.

MATERIALS HANDLING SYSTEM—Information. Dempster Brothers, Inc. See page 196.
Circle E4 on postcard.

TUBE SUPPORTS—Bulletin No. 3150-G. The Duraloy Co. See page 230.
Circle E9 on postcard.

MECHANICAL SEAL—Catalog No. 455-PR. Durametallic Corp. See page 238.
Circle E10 on postcard.

TUBE CLEANERS—Bulletin Y-34. Elliott Company. See page 53.
Circle F2 on postcard.

CENTRIFUGAL BLOWERS—Details. Elliott Company. See page 161.
Circle F3 on postcard.

MECHANICAL AND PROCESS EQUIPMENT—Brochure. Engineering Corporation of America. See page 254.
Circle F4 on postcard.

SAFETY-RELIEF VALVES—Manual 51B and Catalog. Farris Engineering Corp. See page 78.
Circle F5 on postcard.

ELECTRIC TEMPERATURE CONTROL AND DETECTION DEVICES—Catalog No. 400. Fenwal, Inc. See page 225.
Circle F6 on postcard.

ADSORBENTS—Samples. Filtrol Corp. See page 229.
Circle F7 on postcard.

EXPANSION JOINTS—Bulletin. Flexonics Corp. See page 182.
Circle F9 on postcard.

TRAY PACKING—Folder. Fractionating Towers, Inc. See page 250.
Circle G2 on postcard.

CASTABLE REFRACTORIES—Information. A. P. Green Fire Brick Co. See page 81.
Circle G4 on postcard.

CONCRETE CONSTRUCTION—Bulletins. Gunite Concrete and Construction Co. See page 259.
Circle G6 on postcard.

COOLING TOWER FANS—Bulletin 1503. Hartzell Propeller Fan Co. See page 264.
Circle G7 on postcard.

COATINGS—Catalog. Insul-Mastic Corp. of America. See page 19.
Circle H2 on postcard.

WIRE MESH PRODUCTS—Details. The C. O. Jelliff Mfg. Co. See page 242.
Circle H4 on postcard.

THREAD LUBRICANT AND SEAL—Details. Jet-Lube, Inc. See page 252.
Circle H5 on postcard.

ASBESTOS CORRUGATED—Information. Keasbey & Mattison Co. See page 247.
Circle H7 on postcard.

INERT GAS GENERATORS—Bulletin 1-10. The C. M. Kemp Mfg. Co. See page 56.
Circle H9 on postcard.

LIQUID AND VACUUM PUMPS—Bulletin L-51. Kinney Manufacturing Co. See page 250.
Circle J1 on postcard.

KASKADE TRAYS—Information. Koch Engineering Co. See page 72.
Circle J2 on postcard.

OXIDATION INHIBITOR—Details. Koppers Company. See page 178.
Circle J3 on postcard.

MODERN WATER DEVELOPMENT — Movie. Layne & Bowler, Inc. See page 25.
Circle J5 on postcard.

WATER SEPARATORS—Process Manual R-101-53. Warner Lewis Co. See page 253.
Circle J7 on postcard.

TANK TRAILERS—Information. Lubbock Machine & Supply Co., Inc. See page 180.
Circle J8 on postcard.

PNEUMATIC TRANSMITTERS — Bulletin 330. Manning, Maxwell & Moore, Inc. See page 188.
Circle J10 on postcard.

CHEMICAL FEEDERS—Information. Manzel. See page 226.
Circle K1 on postcard.

CONTROLLED VOLUME PUMPS—Bulletin No. 553. Milton Roy Co. See page 45.
Circle K6 on postcard.

VAPOR ELIMINATORS—Details. Mine Safety Appliances Co. See page opp. 97.
Circle K7 on postcard.

CENTRALIZED INSTRUMENTATION—Bulletin 85-20. Minneapolis-Honeywell Regulator Co. See pages 36-37.
Circle K8 on postcard.

VALVES — Bulletin 700-2. Minneapolis-Honeywell Regulator Co. See page 245.
Circle K10 on postcard.

CENTRIFUGAL PUMPS — Information. Mission Manufacturing Co. See page 57.
Circle L1 on postcard.

MIXING EQUIPMENT—Catalogs. Mixing Equipment Co. See page 88.
Circle L2 on postcard.

PUMP SELECTOR. Nagle Pumps, Inc. See page 238.
Circle L4 on postcard.

FUEL OIL-GAS BURNERS—Information. National Airoil Burner Co. See page 254.
Circle L5 on postcard.

REGULATING VALVES — Bulletin 612. Natural Gas Equipment, Inc. See page 168.
Circle L7 on postcard.

REFINERY EQUIPMENT CONSTRUCTION—Information. Newport News Shipbuilding & Dry Dock Co. See page 61.
Circle L8 on postcard.

FILTERS—Catalog NC-1-53. Niagara Filter Division. See page 65.
Circle L10 on postcard.

STEAM TRAPS—Catalog 751. W. H. Nicholson & Co. See page 54.
Circle M1 on postcard.

ELECTRIC FURNACE PRODUCTS — Booklet. Norton Company. See pages 20-21.
Circle M2 on postcard.

FOGGING UNIT — Handbook. Oakite Products, Inc. See page 235.
Circle M3 on postcard.

VALVES—Information. Orbit Valve Co. See page 237.
Circle M4 on postcard.

WEED KILLER—Information. Pacific Coast Borax Co. See page 210.
Circle M5 on postcard.

STAINLESS STEEL WELDING WIRE—Information. Page Steel & Wire Division. See page 248.
Circle M7 on postcard.

DIAL THERMOMETERS—Bulletin 51-129. Palmer Thermometers, Inc. See page 243.
Circle M8 on postcard.

SIDE ENTERING AGITATORS — Details. The Patterson Foundry & Machine Co. See page 249.
Circle M9 on postcard.

PUMPS — Bulletins. Peerless Pump Division. See page 12.
Circle M10 on postcard.

REFINING PROCESSES—Information. Perco Division, Phillips Petroleum Co. See page 24.
Circle N1 on postcard.

VALVE CONTROLS—Catalog L-50. Philadelphia Gear Works, Inc. See page 4.
Circle N4 on postcard.

HEATING AND COOLING PROCESS COILS—Bulletin P78. Platecoil Division, Tranter Manufacturing Co., Inc. See page 256.
Circle N5 on postcard.

LUBRICATED PLUG VALVES—Catalog PV-2. The Wm. Powell Co. See page 23.
Circle N6 on postcard.

BUBBLE CAPS AND RISERS—Catalog 52. The Pressed Steel Co. See page 32.
Circle N7 on postcard.

AIR FOAM EQUIPMENT — Information. Pyrene Manufacturing Co. See page 185.
Circle P1 on postcard.

FURFURAL—Information. The Quaker Oats Co. See page 55.
Circle P2 on postcard.

FLUID COKING PROCESS — Information. The Refinery Engineering Co. See page 42.
Circle P5 on postcard.

HEAT EXCHANGER TUBES — Booklet SPI-53. Republic Steel Corp. See page 73.
Circle P7 on postcard.

CONDENSER TUBES AND PLATES — Booklet. Revere Copper and Brass Inc. See page 159.
Circle P8 on postcard.

DIAL THERMOMETERS—Information. Rochester Manufacturing Co. See page 211.
Circle Q1 on postcard.

FIRE-FIGHTING PRODUCTS — Booklet. Rockwood Sprinkler Co. See page 31.
Circle Q3 on postcard.

UNIONS — Information. Rockwood Sprinkler Co. See page 207.
Circle Q4 on postcard.

CENTRIFUGAL UNITS—Bulletins. Roots-Connersville Blower Corp. See page 183.
Circle Q5 on postcard.

MIXERS — Catalog. Sawyer-Jensen-Ross Co. See page 246.
Circle Q6 on postcard.

HEAT TRANSFER EQUIPMENT—Bulletin HT-1. Schutte and Koerting Co. See page 41.
Circle Q8 on postcard.

HEAT EXCHANGER TUBES — Booklet. Scovill Manufacturing Co. See page 60.
Circle Q9 on postcard.

PUMP VALVES—Bulletin PR-1. Sims Pump Valve Co. See page 242.
Circle R1 on postcard.

PUMPING UNIT—Literature. Southern Engine & Pump Co. See page 235.
Circle R2 on postcard.

PROTECTIVE COATINGS — Information. Sprine Packing Corp. See page 63.
Circle R4 on postcard.

STEAM TURBINES—Bulletin S-116. The Terry Steam Turbine Co. See page 48.
Circle R9 on postcard.

TEMPERATURE CONTROLLERS—Bulletin 50X and 55X. Thermo Electric Co. See page 64.
Circle S1 on postcard.

RADIOACTIVITY — Booklet. Tracerlab Inc. See page 213.
Circle S3 on postcard.

PUMP PACKING, V-RINGS AND GASKETS—Catalogs No. 711, 810-V and 1-339 WA. United States Gasket Co. See page 219.
Circle S4 on postcard.

SHELL AND TUBE HEAT EXCHANGERS—Bulletin HE-6. Henry Vogt Machine Co. See page 44.
Circle S8 on postcard.

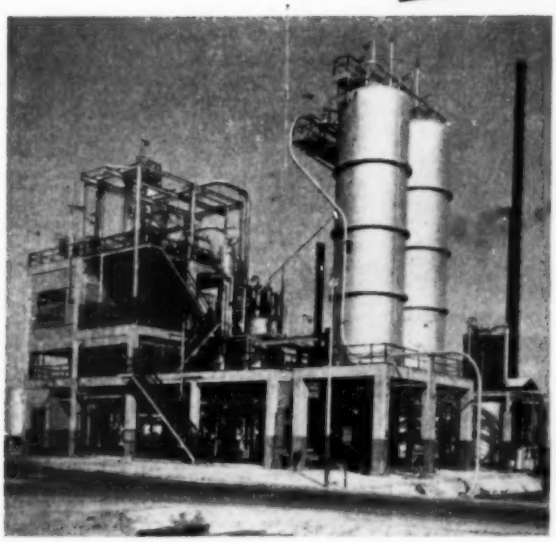
PROCESS VALVES—Bulletin 698. W-K-M Company. See page 175.
Circle S10 on postcard.

GATE VALVES—Bulletin 106. Walworth Company. See page 47.
Circle T1 on postcard.

List Continued on Page 30

there are barrels of difference in adsorbents

and *Filtrol* makes the difference



Shell's Contact Filtration Plant at Cardon Refinery, Venezuela

Refineries everywhere specify Filtrol adsorbents to refine more barrels of premium oils at lower cost.

Reasons Why Leading Refineries Everywhere Use Filtrol Adsorbents For Maximum Throughput . . .

1. **Press cake losses are reduced.**
2. **Filter capacities are increased.**
3. **Highest yields of finished oils.**

The technical service of Filtrol petroleum engineers and laboratories is at the disposal of refiners to assist them in product improvement, to decrease operating costs and increase production. Samples of Filtrol adsorbents and quotations submitted upon request.

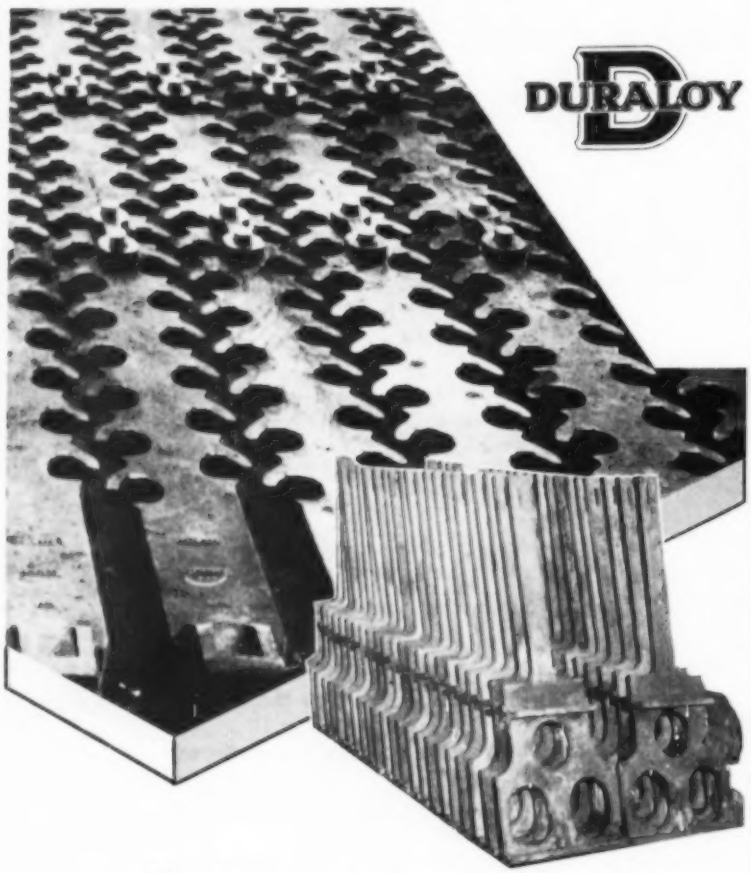
*Filtrol** CORPORATION

GENERAL OFFICES: 722 WEST SEVENTH ST., LOS ANGELES 17, CALIFORNIA
PLANTS: VERNON, CALIF.; JACKSON, MISS.; SALT LAKE CITY, UTAH

*T. M. REG. U. S. PAT. OFF.

WORLD'S LARGEST MANUFACTURER OF CATALYSTS AND ADSORBENTS

CORROSION RESISTANT
HEAT RESISTANT
Tube Supports



You can't buy Better Tube Supports . . . DURALOY Tube Supports are alloyed to meet individual corrosion and heat requirements. They are alloyed by experienced metallurgists and melted and cast by experienced high-alloy foundrymen, both groups with experience going back some thirty years. Castings are carefully tested in our own laboratories which are completely equipped for metallurgical, chemical and physical testing.

Many refineries have been DURALOY customers for years. Many refineries insist upon DURALOY castings. Whether its straight production or engineering plus production, we are equipped to do the job. For more information, send for Bulletin No. 3150-G.

THE DURALOY COMPANY

Office and Plant Scottdale, Pa. • Eastern Office 12 East 41st Street, New York 17, N.Y.

Detroit Office 2195 Woodward Avenue • Pleasant Ridge, Mich.
Atlanta J. M. TULL Metal & Supply Co. Chicago P. O. NELSON 332 S. Michigan Avenue

METAL GOODS CORP. Dallas • Denver • Houston • Kansas City • New Orleans • St. Louis • Tulsa

New Equipment Literature . . .

FORGED STEEL FITTINGS—Literature. Watson-Stillman Fittings Division. See page 87.
Circle T3 on postcard.

LEASE-RENTAL HOMES — Folder. Whitmor Homebuilders, Inc. See page 22.
Circle T5 on postcard.

STEAM TURBINES — Bulletin 1966. Worthington Corp. See page 14.
Circle T7 on postcard.

CENTRIFUGAL PUMPS — Bulletin W341-B16. Worthington Corp. See page 15.
Circle T8 on postcard.

STEAM TRAP — Selector. Yarnall-Waring Co. See II Cover.
Circle U1 on postcard.

DEMISTER—Catalog 13. Otto H. York Co. See page 176.
Circle U2 on postcard.

EXPANSION JOINTS AND SERVICES—Bulletin 351. Zallea Brothers. See page 59.
Circle U3 on postcard.

Research Specialist Dow Lists As New Employe Classification

A new employe classification, "research specialist," has been established by The Dow Chemical Company, and Dr. L. K. Frevel of the Spectroscopy Laboratory has been named as the first scientist accorded that rank.

Purpose of the classification is to give recognition for research ability equal to that afforded by administrative classifications.

Creation of the new title "gives concrete expression to the company's long-maintained principle that exceptional research ability is of equal importance with exceptional supervisory ability. It is expected that this action will encourage the choice of research as a career."

Eligibility for the classification requires "a notable record of achievement in research and devotion to the high standards of science as a profession."

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF WORLD OIL, published monthly at Houston, Texas, for October, 1953.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ray L. Dudley, 3371 Chevy Chase, Houston, Texas; Editor, Dr. John J. McKetta, 5321 Longmont, Houston, Texas; Managing Editor, Silas H. Ragsdale, 1636 North Blvd., Houston, Texas; Business Manager, A. L. Burns, No. 7 Chelsea Place, Houston, Texas.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) The Gulf Publishing Company, Houston, Texas; James Anderson, Houston, Texas; June Wooden Bliss, Houston, Texas; June Wooden Dudley Bliss—Trustee, Houston, Texas; A. L. Burns, Houston, Texas; Mrs. Grace C. Carter, Tulsa, Oklahoma; Mrs. Margaret D. Cashman, Houston, Texas; P. Stinson Dudley, Gainesville, Texas; Ray L. Dudley, Houston, Texas; Wm. G. Dudley, Houston, Texas; Wm. V. Gross, Utopia, Texas; Carolyn Dobson Keeble, Pecos, Texas; Mrs. Anita S. Lane, Houston, Texas; Charles H. Lane, Houston, Texas; James William Nelson, Baytown, Texas; Tom W. Nelson, Houston, Texas; J. Kent Ridley (Deceased), Houston, Texas; Walter Gage Sterling—Trustee, Houston, Texas; O. R. Walter, Chicago, Illinois; Mrs. Patricia McFarland Windham, Austin, Texas.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) M. D. Anderson Foundation, Houston, Texas.

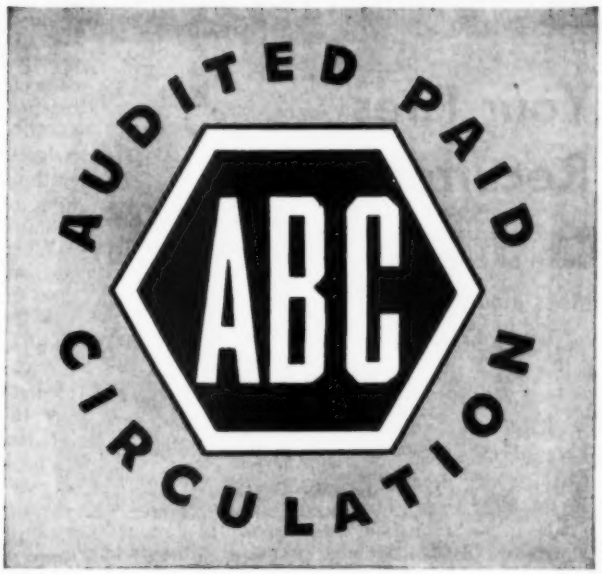
4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

A. L. BURNS, Business Manager.

Sworn to and subscribed before me this 10th day of September, 1953.

P. J. AUCOIN,
(Seal) Notary Public in and for Harris County, Texas.
(My commission expires June 1, 1955.)



The Hallmark of Circulation Value

Three thousand four hundred and fifty advertiser, agency and publisher members of the Audit Bureau of Circulations have a voice in establishing and maintaining the standards responsible for the recognition of this emblem as the Hallmark of Circulation Value. It represents the standard of value that these buyers and sellers of advertising space have jointly established as measurement for the circulation of printed media.

The basis for arriving at the advertising value of a publication is the Bureau's single definition of net paid circulation. With this as the standard, the circulation records of A.B.C. publisher members are audited by experienced circulation auditors. As specified in the Bureau's Bylaws, A.B.C. auditors have "access to all books and records."

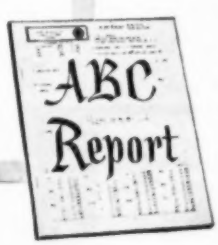
Subscription and renewal orders, payments from subscribers, paper purchases, postal receipts, arrears are among the publisher's circulation records that are painstakingly checked by auditors and the resulting data are condensed and published in A.B.C. Reports.

Experienced space buyers use the audited information in A.B.C. Reports as a factual basis for their decisions in evaluating, comparing and selecting media. The FACTS in A.B.C. Reports for business publications include: • How much paid circulation • How much unpaid distribution • Occupational or business breakdown of subscribers • Where they are located • How much subscribers pay • Whether or not premiums are used • How many subscribers in arrears • What percentage of subscribers renew.

This publication is a member of the Audit Bureau of Circulations and is proud to display the Hallmark of Circulation Value as the emblem of our cooperation with advertisers. Ask for a copy of our A.B.C. Report and then study it.

SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.



PETROLEUM REFINER

A.B.C. REPORTS—FACTS AS A BASIC MEASURE OF ADVERTISING VALUE

As **Management** Sees It . . .

Investigate Your Fires To Prevent Recurrence!

- Determine the cause of each fire
- Assess the total loss incurred
- Count the lessons to be learned

Franklin G. Wilson, Director, Safety & Fire Protection Services, American Petroleum Institute, New York

THOROUGH INVESTIGATION of fires can play an important role in improving the petroleum industry's fire record. Too often reports of fires lead off with the words: "A fire of undetermined origin . . ."

Neither the individual oil companies nor the industry learn anything from such reports. The result is that fires of similar nature may recur as a result of identical conditions within the industry. These fires possibly could be prevented if a complete investigation and analysis of the conditions obtained at the time of the fire had determined the probable cause, and set forth recommendations for preventive measures to avoid a recurrence.

Each fire prevented helps to improve the industry's record. While it's true the record is good and has steadily improved over the years, it can always be made better.

Proper investigations will discover new lessons from fires. This should be one of the paramount functions of the fire protection staffs of oil companies. It will help in the basic preventive practices, which are to establish fundamental safety policies; to make inspections and recommendations against unsafe operating conditions and procedures; to review plans for new operations; and to develop and conduct fire prevention and extinguishment training programs.

What is a proper and complete investigation of a fire? It should have three underlying purposes:

- Determine the cause of the fire. Only when the basic cause is known can you possibly take steps to avoid recurrence.
- Determine accurately the total loss incurred. Unfortunately, news reports of petroleum fires usually contain exaggerations, either because no attempt was made by the reporter to get the true picture or because the oil company suffering the fire could not give out factual information, such as the estimate of the loss. Such figures are extremely difficult to determine at the time of the fire, and by the time accurate estimates could be prepared the fire would no longer be considered news.
- Determine the lessons to be learned. There is a lesson to be learned

Continued on Page 233

MANUFACTURERS AND JOBBERS OF **SCIENTIFIC INSTRUMENTS**

Write for Bulletin Number 50

"HOME OF" **Ac-Me & R. S. SPECIALTIES**

Ac-Me RECORDING GRAVITOMETER
Ac-Me SPECIFIC GRAVITY GAS BALANCE
Ac-Me PRESSURE VACUUM PUMP
R. S. MERCURY CLEANER
R. S. MANOMETER
R. S. DEAD WEIGHT GAUGE
R. S. DEAD WEIGHT TESTER
R. S. ORIFICE WELL TESTER
R. S. MOISTURE TESTER
R. S. FLAT BORE YEL-O-BAK THERMOMETERS
R. S. STREAMLINED HYDROMETERS
R. S. PULSAMETER
R. S. PRESSURE HYDROMETER JARS
R. S. VAPOR PRESSURE BOMB
R. S. DIAMOND CORE DRILL
R. S. THERMO PLUMB BOB THERMOMETERS
R. S. SUPER PRESSURE CONSISTOMETER
R. S. SMOKE METERS

COMPLETE LINE OF SCIENTIFIC LABORATORY EQUIPMENT INCLUDING CENTRAL SCIENTIFIC SPECIALTIES

CENCO

Cenco . . . one dependable source of supply for everything you need in scientific instruments and laboratory supplies. Over 15,000 items . . . 14 branch offices and warehouses.

R.S.C. TULSA

REFINERY SUPPLY COMPANY
621 EAST FOURTH STREET • TULSA 3, OKLAHOMA
2215 McKINNEY AVENUE • HOUSTON 3, TEXAS

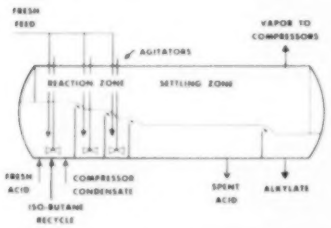
CENTRAL SCIENTIFIC COMPANY
1700 IRVING PARK ROAD • CHICAGO 13, ILLINOIS
CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

REFINERY PROCESS NEWS

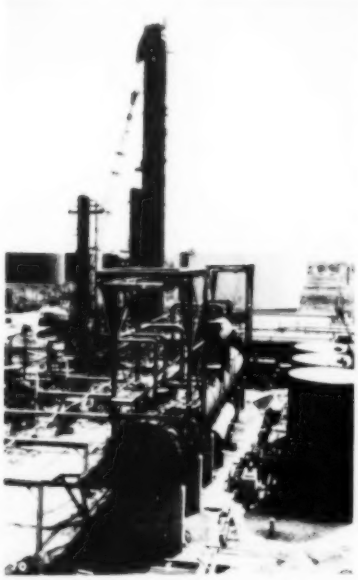
PUBLISHED BY REFINERY PROCESS DIVISION, THE M. W. KELLOGG COMPANY OCTOBER 1953

Another Alkylation Plant Well Underway

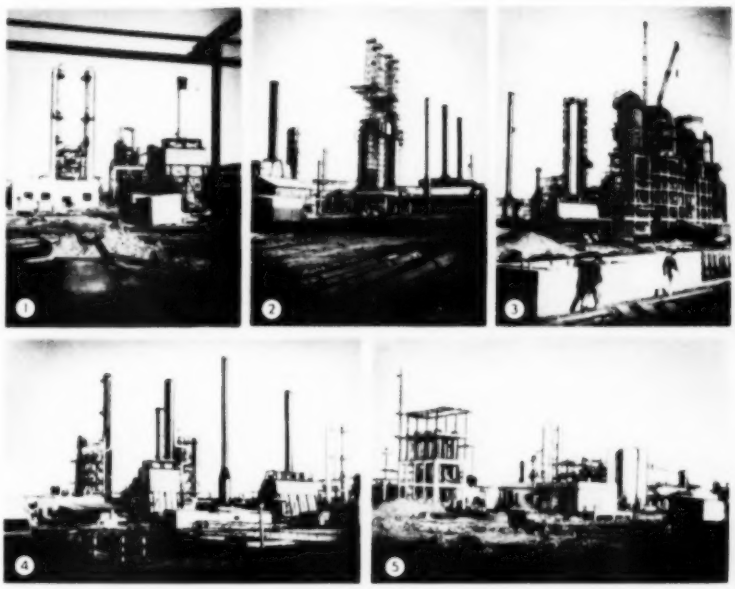
One of six Kellogg-designed alkylation units now in engineering or under construction, this one (see below) for a major East Coast refiner includes, as do the others, the unique Kellogg cascade reactor system, which has consistently produced the highest yield octane ratios at a minimum consumption of sulfuric acid.



Most important of the reasons for the improved efficiency of this new reactor is a design which provides for an unusually high isobutane-butylene ratio in the reaction phase. The reaction progresses most satisfactorily when the ratio is considerably in excess of the theoretical 4-1 ratio; Kellogg's design provides a 9-1 ratio without an increase in pumping or vessel costs.



Shown in the foreground is the Kellogg alkylation reactor. Large tower in the rear is the main isobutane-alkylate fractionator. The drums to the right are for sulfuric acid storage.



New Argentine Refinery Reflects Spread of U. S. Refining Techniques Abroad

One of six complete refineries now underway by Kellogg outside North America, this complete catalytic refinery for Yacimientos Petroliferos Fiscales in Argentina is indicative of the spread of modern U. S. refining techniques to countries which have been largely dependent upon imports to supply their needs for finished petroleum products. When on stream the new plant will have helped increase that country's domestic sources of refined oil by more than 30%.

It will be South America's most modern refinery in that it will contain most of the major catalytic processes currently employed to meet the high octane demands of the U. S. market.

Shown in the photographs are units for carrying out the eight principal processing steps to be included: (1) straight-run gasoline fractionation and vacuum distillation, (2) thermal cracking and delayed coking, (3) fluid catalytic cracking, (4) crude distillation, (5) catalytic polymerization and sulfuric acid alkylation. Not shown are product-treating units and the powerhouse.

Two indigenous crudes, Challaco and Comodoro Rivadaria, in a ratio of 25% to 75% respectively, will be charged to the refinery. Major final products will include nearly 2,500 BPD of aviation gasoline and more than 2,000 BPD each of diesel and fuel oil. The delayed coker, in preparing clean feed stock for the Fluid Catalytic Cracking Unit, will produce more than 600 tons of high quality coke daily.

One of Several Major Refinery Jobs in S. A.

This $70,600,000 Argentine refinery is only one of several major Kellogg projects currently underway in South America. These include two complete refineries of 5,000 BPD and 10,000 BPD capacities and nitrogen fertilizer facilities, at three different locations in Brazil, and a complete 20,000 BPD refinery in Chile.

In other parts of the world Kellogg projects include a complete 24,000 BPD thermal refinery in Iraq and a 70,000 BPD catalytic refinery for Australia, which will supply about 40% of that country's current product requirements.

(SEE REVERSE SIDE)

CONTINUED FROM PRECEDING PAGE

Capacity of MWK Fluid Units Now Over Million BPD

The signing of several recent contracts for new Orthoflow Fluid catalytic crackers has brought the total fresh feed capacity of Kellogg-engineered FCCU's to well over 1,100,000 barrels per day. Included in this capacity are units ranging from 2,000 BPD to 63,000 BPD at locations all over the world.

When all these plants are operating, they will produce better than seven billion gallons of high quality motor gasoline annually or enough to provide every automobile in the world with an annual supply of about 100 gallons of gasoline.

One Out of Four Gallons From Kellogg Designed Units

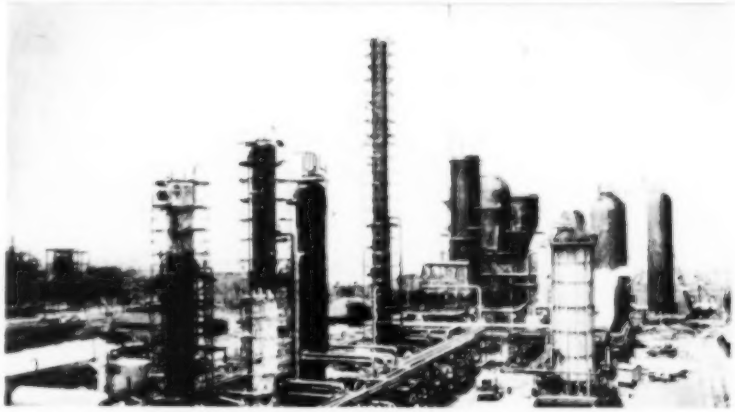
The figures above refer only to the production of Kellogg Fluid catalytic cracking units and do not include the billions of gallons of gasoline being produced by other types of Kellogg designed plants. An indication of the total gasoline making capacity of all Kellogg plants is the fact that approximately one out of every four gallons of gasoline purchased in North America comes from plants built by Kellogg.

Europe, South America and Australia Adopt Fluid Process

It is well known that Fluid catalytic cracking dominates the gasoline industry today. In fact, approximately 63% of the world's catalytic cracking capacity is of this one type.

While this process has been dominant in domestic and Canadian refining since World War II, it is now beginning to play an increasingly important part abroad, where a number of leading refiners are installing catalytic crackers. Indicative of this is the fact that Kellogg has recently completed three fluid plants in the British Isles, is about to complete one in South America, and has started construction on still another as part of a complete refinery project in Australia. In continental Europe an Orthoflow Fluid catalytic cracker has just been completed and another is currently underway.

Two Big Cat Crackers in Philadelphia



This huge (63,000 BPD) Fluid catalytic cracking unit will soon be on stream. Workmen are already installing insulation on the towers of the plant's gas recovery section. (Below) At another site in Philadelphia construction of the largest Fluid catalytic cracker (45,000 BPD reactor throughput) yet to employ Kellogg's unique Orthoflow design is progressing rapidly.

"Why's" as Important as "How's" in Manuals

Although operating manuals are not as dramatic as the actual construction of a plant, properly prepared instructions on the functioning of a refining unit play a vital part in its eventual success.

This is particularly true of refineries outside the U. S. where design specialists are not always immediately available. But to do the job best, the manuals must go beyond explaining the various steps required to start up and operate a plant. They should also be a guide for understanding the overall process—not just the mechanics of running it. They should tell "why's" as well as the "how's."

The way these "why's" and "how's" are told is important. Kellogg is continuously working on the problem of condensing this material into its most convenient form without eliminating any necessary information.

For further information, technical data, etc., on any refining process, write

REFINERY PROCESS DIVISION

THE M. W. KELLOGG COMPANY

225 Broadway, New York 7, N. Y.

Also Jersey City, Los Angeles, Tulsa, Houston, Toronto, London and Paris

KELLOGG PULLMAN

Investigate Your Fires!

Continued from Page 232

from almost every fire that occurs. Sometimes the *contributing factors are far more important than the basic cause of the fire.*

Those concerned with fire protection in the petroleum industry have the benefit of an informational service rendered by the American Petroleum Institute through its Fire Protection Circulars. This dissemination of reports of fires has been instrumental in the maintenance and improvement of the industry's fire protection record. The fire circular service began in 1935 and has continuously provided the industry with factual data concerning causes of fires, methods of extinguishment, and recommendations to prevent recurrence. These lessons have been drawn from the most important fires that have occurred in the industry.

Trade Experiences. With this type of information each man responsible for fire protection within the industry can check the operations within his own company or plant against someone else's experience. He does not have to wait for a similar fire to hit his plant. It is the "someone else's experience" that is most valuable to the industry, when after a thorough investigation, a report of a fire (with identifying references deleted) can be made available to all oil companies.

To find the causes of fires and to determine the lessons that can be learned, admittedly are sometimes difficult tasks, but without such investigations there is little that may be learned from a fire—or how to prevent a recurrence.

One thorough investigation job of a truck filling stand fire proved to be of great importance to the industry's fire prevention efforts. An employe in the act of closing the dome cover on a tank truck let the detachable magnesium loading spout fall after one compartment had been filled with gasoline. It struck the concrete driveway and flames flashed upward igniting the compartment dome. That was the eyewitnesses' story.

Now, magnesium is a soft metal and generally considered to be non-sparking, hence there was considerable skepticism of the witnesses' reports of the initial source of ignition. Extensive laboratory tests failed to produce sparks from a similar loading spout. Subsequently, discussions with metallurgists and study of a report of a similar fire in another company proved that what the eye witnesses saw actually could have happened. It was possible to obtain ignition from the magnesium spout striking the concrete *because of an incandescence created by the force of the blow in combination with the chrome-pickle treatment given the spout to minimize corrosion.* One of the recommendations by the investigator was that the loading spout should be replaced with an aluminum one, thereby eliminating this source of ignition.

The careful investigation of this fire produced several other recommendations important to the industry. They were lessons learned from the factors contributing to the severity of the fire. They involved changes in design of equipment and recommended safety

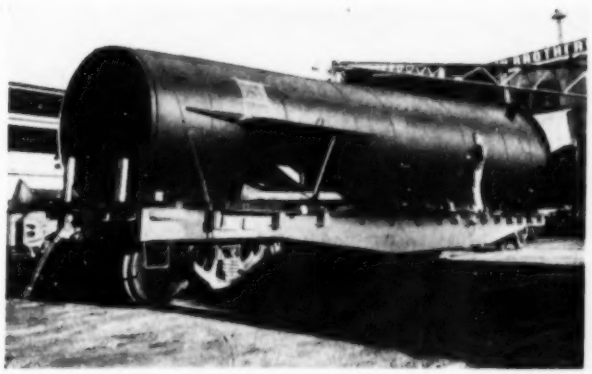
As **Management** Sees It . . .

practices which will improve product handling.

As to determining losses, it is extremely difficult, if not impossible, during a fire to properly estimate the loss that has been incurred. However, petroleum fires, even when small, seem always to make page 1 news and usually contain overstated estimates of losses. News reports of oil fire losses are frequently from three to five times greater than the actual loss. Such publicity seriously distorts the industry's good fire record in the public mind.

Aid the Press. Cooperation with

STEEL is BETTER



. . economy of Construction
. . endurance in Service

Shown is the bottom section of another big 120-ft. Stack furnished to C. F. Braun for Esso Standard Oil Co. at Baton Rouge, La.

This section weighed 36,930 lbs. was 50 feet in length, with the diameter belled out from 6 ft.-4 in. to 11 ft.-4 in.

STRUCTURAL STEEL • REINFORCING STEEL

STEEL WAREHOUSE PRODUCTS

AUSTIN BROTHERS STEEL CO.

GENERAL OFFICES
1815 COOMBS STREET
DALLAS 1, TEXAS

PLANTS
DALLAS, TEXAS
HOUSTON, TEXAS

...But Down Went High Insurance Rates when
ALGRIP Ended Man-Crippling Accidents!

ELIMINATED:
Dangerous slips and falls that hampered production.

SAVED:
The high cost of added compensation premiums.

A trickle of oil—an unwary foot—more man-hours lost. This was the accident pattern in the drum-filling room of a mid-western refinery. And as safety records slumped, compensation premiums went soaring.

A.W. ALGRIP Abrasive Rolled Steel Floor Plate brought accidents *and* high premiums to an end. For ALGRIP is truly non-skid—even when wet or oily—even on steep inclines! By an exclusive process, we roll tough, "grinding-wheel" grain deeply and uniformly into steel plate's upper portion. When you step on ALGRIP, you can *feel* the hundreds of tiny, abrasive safety-brakes gripping your feet at every step. And since wear only exposes new particles, ALGRIP *stays* slip-proof.

It's easy to get *savings from safety*. Learn how today. Write for full details of A.W. ALGRIP, the *floor plate that pays for itself*. Booklet AL-19 tells the whole story.

Over 125 Years of Iron and Steel Making Experience

ALGRIP Abrasive Rolled Steel Floor Plate
ALAN WOOD STEEL COMPANY
CONSHOHOCKEN, PA.
Other Products: A. W. SUPER DIAMOND Floor Plate • Plates • Sheet • Strip (Alloy and Special Grades)

As **Management** Sees It . . .

the working press by authorized company representatives at the fire scene can prevent bad publicity. One good example of such cooperation occurred when a fire broke out in a refinery cracking plant near a large city. Upon arrival at the scene, press photographers were conducted to a safe place near the fire from which acceptable pictures were made. The refinery management met with reporters and gave a clear story of the fire. The result was accurate newspaper coverage with a minimum of dramatic embellishments.

Press accounts of most petroleum fires usually manage to get in an "explosion," when in most cases none has occurred. In the news report of one fire involving an oil company tank truck garage, the published stories referred to frequent "explosions" of the gasoline "stored in the building." After a preliminary investigation following the fire, the protection engineer found that the so-called gasoline "explosions" were the bursting of tires on the trucks exposed to heat in the garage.

Another front page story described a fire resulting from spilled gasoline when a tank truck had been hit by a string of railroad cars being pushed over a street crossing. The story stated that the gasoline "exploded" in the truck and started fires in surrounding buildings. Yet, just above the story was a picture, made after the fire had been extinguished, which showed the truck's cargo tank on its side but completely intact—proof enough that no "explosion" had occurred.

Such investigations to determine the losses are important, and are not too difficult. Once ascertained, the true losses should be published. This is particularly important when previous press accounts have shown them to be much greater than later established by investigation.

Even the simplest fire should be investigated, since there is a possibility that important lessons in fire protection may be learned. A fire protection engineer investigating a recent fire at a loading rack was told that it had started when a truck approaching the rack backfired while another truck was being filled. This fire was not considered important because the loss was small. At the outset indications were that nothing new in the way of fire protection information would be learned. Undoubtedly, a backfire could have ignited gasoline vapors and caused a fire.

The obvious recommendation to be made in the investigator's report would be that trucks should not be driven into the loading rack while others are

A PROVEN GATE VALVE LINE BLIND

GREENWOOD

SIMPLE

RUGGED

DEPENDABLE

Because of its extreme simplicity and lack of moving parts the GREENWOOD GATE VALVE LINE BLIND is recognized as one of the most dependable and economical line blind valves on the market today! Check these outstanding GREENWOOD features:

- **Has Metal Seats Between Gate and Valve Body.**
- **O-Rings Act as Secondary Seals and Are Specially Compounded of Synthetic Rubber.**
- **Made of Cast Steel and Built to Gate Valve A.S.A. Specifications.**
- **One Operator Can Change Blinds Since It Is Not Necessary to Lift Both Wedges at Once.**
- **Available in Sizes From 2" to 12", Flange Type.**

PATENT PENDING

GREENWOOD GATE VALVE LINE BLIND

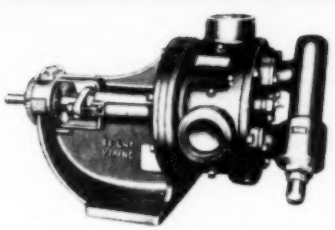
Write for GREENWOOD VALVE CATALOG

Manufactured by
GREENWOOD VALVE DIVISION
VERNON TOOL CO., Ltd.

1091 Meridian Ave.
Alhambra, California

P. O. Box 7555
Houston 7, Texas

VIKING *Truck Mounting* PUMPS



The new improved Viking Truck Mounting Pump incorporates outstanding features: an improved bracket base with extra long packing chamber; a new style double supported valve on head; a revolvable type pump case which allows complete selection of ports. Available in units from 35 GPM to 300 GPM sizes. Write for literature.

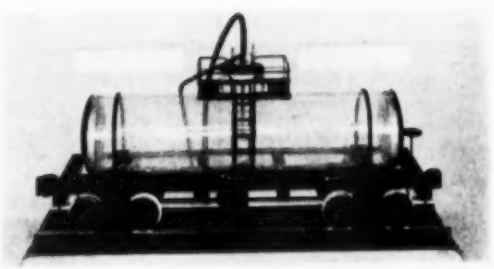
Distributor

SOUTHERN ENGINE & PUMP COMPANY

MANUFACTURERS • MACHINERY FACTORS • CONTRACTORS

Houston — Dallas — Kilgore — San Antonio
Edinburg — Corpus Christi, Texas
Houma and New Orleans, Louisiana

This unit makes light work of tank car cleaning



SO LIGHT one man can carry it—yet it does the work of a whole crew, in half the time. It's the new Oakite Fogging Unit, and it's making tough tank car cleaning a simple job.

No more brushing or scraping out—the unit does the work. Just suspend it in the dome of the tank, hook it up to the cleaning solution and steam lines. Unit automatically picks up the solution, mixes it with steam, turns loose a detergent-saturated fog that quickly penetrates and loosens moderate soils. A rinse through the nozzles floats the dirt off all interior surfaces, leaves tanker ready for service.

You can rent the Oakite Fogging Unit at a nominal fee. Just ask your Oakite Technical Service Representative, or write Oakite Products, Inc., 50B Rector St., New York 6, N. Y., for free handbook describing this, other modern Oakite cleaning methods.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

aromatics...

7 in a row

In various stages of engineering and construction are the following:

1—Naphthalene Purification—a continuous distillation unit to make high quality Naphthalene. In successful operation.

2—Tar Distillation—a continuous tar distillation unit making special coal tar pitch. Ready for operation.

3—Aromatic Recovery—a unit to recover aromatics from petroleum stocks. Now under construction.

4—Naphthalene Purification—a combination crystallization and distillation unit to make high purity Naphthalene. Now under construction.

5—Tar Acid Recovery—a special stripping unit to recover tar acids from plant wastes. Under construction.

6—Para Xylene Recovery—a low temperature crystallization unit to make high purity Para Xylene. Under construction.

7—Para Xylene Recovery—a low temperature crystallization unit to make high purity Para Xylene. Completing engineering.

Aromatics is but one of the many divisions of processing in which our engineers are experienced. The country is dotted with successfully operating plants with which they have been associated in a design capacity. Particularly numerous are plants involving high or low pressure distillation, azeotropic and extractive distillation, extraction, absorption, and crystallization.

Engineering

Design and Construction of Process Plants

•

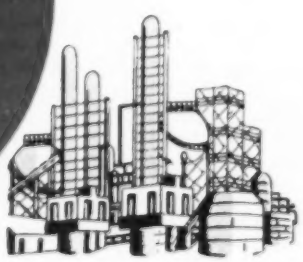
Design and Construction of Process Units

•

Process Evaluations

•

Economic Studies



BADGER MANUFACTURING COMPANY

230 BENT STREET, CAMBRIDGE 41, MASS. • 60 EAST 42nd STREET, NEW YORK 17, N.Y.

being loaded. Such a procedure would eliminate a source of ignition. However, the investigator was interested to discover why there was a fire even though there was a source of ignition present. He aimed his investigation at learning why there was enough gasoline spilled on the ground during the loading operations to feed a fire over a considerable area for fully five minutes. Once the reason for the loss of product on the ground was established, the real cause of the fire was learned and the proper remedy was applied.

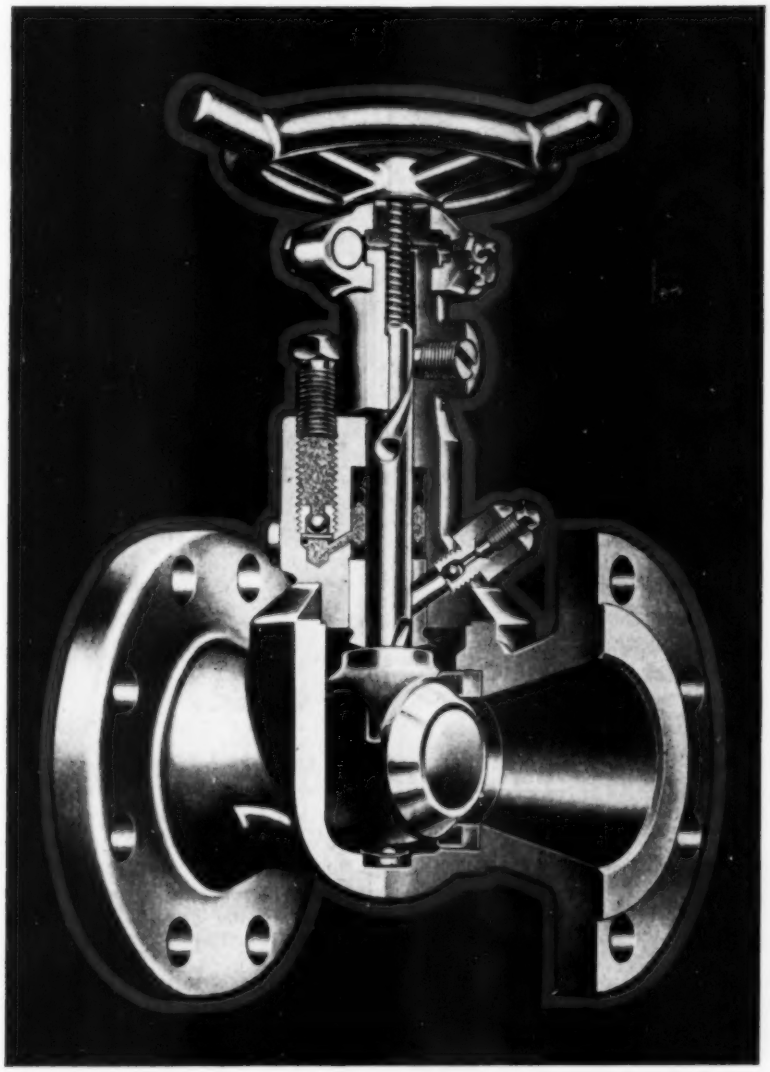
In many other instances, full investigations uncover the fact that while elaborate fire fighting measures are initiated, simple shutdown procedures are overlooked. The failure to close a product valve in one case permitted the flow of gasoline to continue and feed a fire needlessly. In another investigation it was learned that while the nightwatchman who discovered the blaze turned in the proper alarms, and did his best with a hand fire extinguisher, he completely forgot to turn on an elaborate "dry" sprinkler system that probably would have extinguished the fire immediately.

Rarely are two fires caused by identical sources of ignition, or from the same source of fuel. Neither are the actions (or lack of actions) of individuals near the scene of the fire identical. Nor can investigations of fires all be conducted alike. So there can be no hard and fast rules or procedure to follow that will insure a proper investigation of every fire. Careful investigation will be productive of better results, however, if the fire protection engineer can sell management and employes alike on the fact that the reasons for investigations are:

- To determine how to avoid recurrence—rather than to fix blame for something that has already happened.
- To get pertinent related facts—rather than to "learn" things that are not true or have no significance.
- To check on design and operation of equipment—so as to develop improved design and better operations.
- To ascertain where more intensive training and *beforehand* investigation are needed for greater familiarity with equipment and operational procedures. Equipment provided for fire protection is not always used properly. The location of fire-fighting equipment in the plant and locations of emergency shutoff valves can often be improved.

As part of his fire investigations, the fire protection engineer should always compare the results of fires that have

Concluded on page 238.



ORBIT VALVES ®

VENTURI TYPE LP-GAS VALVES ASA CLASS

Flanged End Only

Raised Face
Ring Joint

Carbon Trim
Stainless Trim

(MAXIMUM RATED WORKING TEMPERATURE 250° FAHR.)

AVAILABLE SIZE RANGE

ASA CLASS	VALVE SIZES	ASA CLASS	VALVE SIZES
150-Lb.	2", 2½", 3", 4"	900-Lb.	3", 4"
300-Lb.	2", 2½", 3", 4", 6"	1500-Lb.	1½", 2", 2½", 3", 4"
400-Lb.	4"	2500-Lb.	1½", 2", 2½", 3", 4"
600-Lb.	2", 2½", 3", 4", 6"		

LISTED UNDER REEXAMINATION SERVICE UL OF UNDERWRITERS' LABORATORIES, INC. TYPE "G"

The ORBIT FORGED STEEL LP-GAS VALVE has a wide reputation through its ability to hold light vapors at low cost maintenance. This line of Valves features Friction Free Seating with no Lubricant needed to effect a positive shut-off.

Recommended and widely used in the manufacturing, storage and handling of Petroleum Hydrocarbons, Anhydrous Ammonia and many chemicals where Carbon or Stainless Trim Valves are required. ORBIT VALVES are also available in Full Round Opening type. Write for Prices and Specifications.

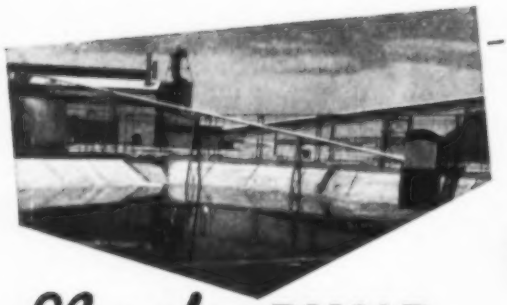
ORBIT VALVE COMPANY — TULSA, OKLA. — U.S.A.

BRANCHES

HOUSTON, TEXAS
407 Velasco
(Serving the Gulf Coast)

CASPER, WYOMING
1740 E. Yellowstone
(Serving the Rocky Mountain States and Canada)

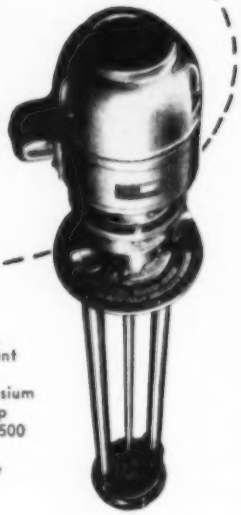
ODESSA, TEXAS
402 West County Road
(Serving West Texas)



Nagle PUMP

EARNS ITS SALT AT SOUTHWEST POTASH CO.

A Nagle 10" Type "SW-B" frame 238X vertical shaft pump, with manganese steel water end parts, is giving excellent service at the Southwest Potash Co., Carlsbad, New Mexico, handling a slurry of sodium chloride and potassium chloride. Solids vary from a few percent up to 50%. Pump is 23' 6" long. Variable operating conditions call for 2500 g.p.m. at 60' of head and 5000 g.p.m. at 57' of head. If yours is a tough or abusive pumping job it calls for Nagle Pumps. Send for copy of "Nagle Pump Selector."



NAGLE PUMPS

NAGLE PUMPS, INC.
1251 Center Ave., Chicago Heights, Ill.

PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

A Book You Should Have on Mechanical Sealing...

A complete reference catalog on Dura Seal—the engineered mechanical seal that rotates with the shaft. Amply illustrated . . . specific applications . . . installation data. A fact book of real value to designers, operators and maintenance departments.

SEND FOR DURA SEAL CATALOG NO. 455-PR

DURAMETALLIC CORPORATION
KALAMAZOO, MICHIGAN

As **Management** Sees It . . .

Accidents seldom happen to experienced, attentive employes, no matter how hazardous their jobs. Here is another case history from an oil company's files revealing why compensation insurance rates are so needlessly high.

The Accident: An employe reported to first aid with a lacerated left ear. He stated that he bumped his ear on a valve stem. Investigation disclosed that during lunch time the injured employe had placed a boiled egg belonging to another employe in a saucer used to feed some stray cats. The offended employe let fly with saucer, striking the jokester on the left ear. Flying saucer caused laceration.

Recommendation: Horseplay is one of the most dangerous forms of carelessness.

INVESTIGATE YOUR FIRES!

Continued from Page 236

occurred that appear to be of similar nature, so as to pinpoint "patterns." The need for reports of all oil company fires for the general information of the industry obviously is important, particularly as an aid to those responsible for fire investigations, fire extinguishments and fire prevention.

As **Management** Sees It . . .

the Iranian oil industry . . .

The overthrow of the Iranian Government of Premier Mohammed Mossadegh by Gen. Fazlollah Zahedi has brought renewed speculation of a possible resumption of oil production for world markets in Iran. The oil industry in Iran as existing when Anglo-Iranian Oil Company, Ltd., was forced to withdraw from its 100,000 square mile concession in southern Iran is immense. It includes:

- Eight oil fields with 87 producible wells, which prior to expropriation had reached a peak output of 731,000 barrels daily.
- A pipe line network totaling 1020 miles of lines from three to 22 inches in diameter.
- Underground crude oil reserves estimated at 13 billion barrels, which may be proved to be an extremely conservative figure.
- The largest refinery in the world at Abadan with capacity for 500,000 barrels daily, and a small skimming plant at Kermanshah with a capacity for 2300 barrels daily.

New Problems Arise in Iran

• Should production resume, a serious threat of oversupply would arise.

• Resulting pressure on prices would be felt in oil fields around the world.

Robert E. Spann,
PETROLEUM REFINER Staff

POSSIBLE RESUMPTION of oil production in Iran for export markets poses greater problems than were created by the shutdown of the giant petroleum industry more than two years ago. Its primary impact—a potentially serious oversupply of petroleum with consequent pressure on prices—would be felt in oil fields around the world.

A return of Iranian oil is still far from reality. Several times since the properties of Anglo-Iranian Oil Company, Ltd., were expropriated on March 15, 1951, a possible settlement appeared near, only to be scuttled by the uncompromising stand of former Premier Mohammed Mossadegh. The biggest obstacle to a possible settlement, however, was removed with the overthrow in mid-August of the 28-month rule of Mossadegh by forces loyal to the Shah, led by Gen. Fazlollah Zahedi.

Early meetings have been indicated by the new Iranian government with Anglo-Iranian Oil. As premier, Gen. Zahedi will set the Iranian policy. He was a leading supporter of Mossadegh's oil "nationalization" law and throughout his political career has been an ardent Nationalist, though a loyal supporter of the Shah. During World War II, Gen. Zahedi was arrested by British agents and interned for the duration in Palestine, charged with collaboration with the Germans. These facts certainly offer no assurances the new government would agree to terms acceptable to A.I.O.C.

The ultimate success of the possible negotiations that may result between Iran and Anglo-Iranian on the oil dispute will depend primarily on:

- Whether the present Iranian Government in the long run can win a real test of confidence with the Iranian people and establish itself as a stable government. It has won an important vote of confidence, however, with the decision of President Eisenhower, with approval of the British Foreign Office, to grant the nation direct financial aid of $45 million and approved the continuation of U. S. technical assistance at an annual rate of $23.4 million.
- Whether Gen. Zahedi will be willing to risk his political life and reverse the position maintained by Mossadegh in the oil dispute. This would involve an agreement by Iran to compensate Anglo-Iranian for loss of physical properties and breach of contract. Only after these claims have been satisfied can Iran expect to resume production in substantial volume.

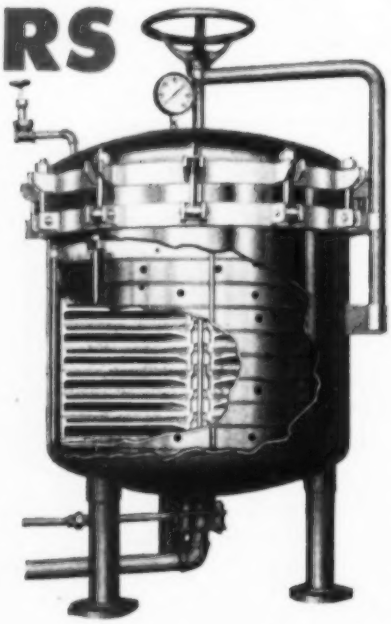
In previous negotiations with former Premier Mossadegh, Anglo-Iranian has held firmly to its position that its claims under the cancelled 1933 concession agreement with Iran must be considered. The company, in its final proposals to the Mossadegh government, offered to submit the claims to arbitration by any international tribunal and indicated willingness to be compensated over a period of years from revenues that would accrue to Iran from oil sales.

A revival of petroleum operations in Iran somewhere near the pre-expropriation level is essential for the long-term economic and political survival of the bankrupt nation. Equally important, it is imperative to the overall success that the marketing of production (if not the actual production operations) be managed by a recognized international petroleum organization.

Market for Oil. Stated briefly, Iran must be willing to face present economic fact: That while it urgently needs revenues from oil sales, the former consumers are no longer de-

SPARKLER
HORIZONTAL PLATE
FILTERS

Noted for High Quality, Consistently Uniform, Fine Sharp Filtration of Petroleum Products....



Many times Sparkler filters have been chosen by experienced filtration engineers in the petroleum field because of these specific features of superiority.

Sparkler filters deliver unusually high flow rates due to the horizontal plate construction that requires only a very thin precoat to produce fine sharp filtration right from the start. Less pressure is required with a thin precoat resulting in a filter cake of less density and high flow capacity. Intermittent operation or variation in pressures will not disturb the stability of the filter cake.

Any grade of filter paper, cloth, or screens, and any filter aid can be used with maximum efficiency because no pressure is required to hold the filter cake on the plate.

Frequently Sparkler filters are used in the petroleum industry with various grades of paper only without filter aid to perform a specific job that would be difficult or impossible with some other types of filters such as the removal of water from diesel lube oil or transformer oil.

A few typical applications of Sparkler Filters to the Petroleum and petro-chemical industries for the filtration of:

- Canned lubricating oil
- Methyl-Ethyl-ketone
- Polyisobutane
- Chlorinated hydro-carbons (carbon tet.)
- Aviation gasoline
- Jet engine fuel
- Hydraulic oil
- Gas engine & diesel lubricating oil (both continuous recirculation on the engine and batch-wise)
- Diesel fuel oil
- Cooling tower water
- Plant effluent water (to obviate stream and lake pollution)
- Removal of Raney nickel from alcohol streams
- Insecticides
- Caustics & acids
- Cottrell precipitator insulating oil (carbon black plants)

Sparkler horizontal plate filters are available in capacities from 30 to 30,000 G.P.H. depending on type of product filtered. Can be supplied in carbon steel, stainless steel, pure nickel, or monel, bronze, Hastelloy and Inconel. Rubber lined, brine or steam jacketed.

Sparkler representatives for personal engineering service are located in Dallas, Houston, San Francisco, and other principal cities. Western Branch, Los Angeles, California.

SPARKLER

Write Mr. Eric Anderson for your nearest Sparkler service representative.

MANUFACTURING COMPANY
MUNDELEIN, ILL.

Sparkler International, Ltd. Prinsengracht 876 Amsterdam, Holland

MAKERS OF INDUSTRIAL FILTERS FOR OVER A QUARTER OF A CENTURY

As **Management** Sees It...

pendent upon oil from Iran. Similarly, other oil producers must recognize the reality that any substantial exportable production from Iran will have to enter western world markets at the expense of production elsewhere if a temporary, or possibly permanent, glut of oil is to be avoided. An attempted "go it alone" policy would be financially disastrous for Iran, as has been proven during the past two years, and could bring serious hardship to the international petroleum industry.

A return of Iranian oil to international trade, even though the possibility may not be realized before next year or even later, would find the pattern of world oil economics considerably changed from that existing prior to mid-1951. First of all, barring the unexpected, Iran could never expect to regain its importance in world petroleum supply that existed in 1950 when the nation produced 6 percent of the world's total crude oil. It is doubtful, also, whether Iran could regain its status as the largest producer in the Middle East.

More important, the trend of world petroleum demand has returned to a more normal rate of annual expansion. And with the increasing growth of supply at a faster rate than the expansion in demand, competition for world markets has sharpened. Just prior to and at the time of the Iranian expropriation, world demand for petroleum was increasing annually from 10 percent to 12.5 percent. In terms of barrels daily, the annual expansion in demand approximated 1.2 million. The gain in demand last year was at the more modest rate of 5.2 percent over 1951, or 634,000 barrels per day, and the indicated gain for 1953 will be about 6 percent, or about 800,000 barrels per day. Similar rates of gain over the next few years are indicated by various long-ranged forecasts.

Production Up. While the rate of new petroleum supply throughout the world has grown at a more rapid rate than demand, the increase in productive capacity has been even greater. Actual new supply has been held in check to a great extent by cutbacks primarily in the U. S. and Venezuela.

UNIFORM

Size
Strength
Finish

Specify...

LARKIN

...Through Your Supply Store

Seamless and Weldless, Larkin Bull Plugs and Swage Nipples provide uniform dependability wherever they may be used.

Larkin also furnishes Swage Nipples and Bull Plugs made from SAE 8620 (Refinery Alloy Steel) in sizes from ⅛" through 2".

LARKIN PACKER CO., INC.
ST. LOUIS, MO.

LARKIN WAREHOUSES: St. Louis, Mo. • Houston, Corpus Christi, Kilgore, Odessa, Wichita Falls, Texas • Oklahoma City, Tulsa, Oklahoma • Shreveport, Louisiana • Los Angeles, California • Great Bend, Kansas • Casper, Wyoming • New York, N. Y.

WIRE MESH

Maybe it all *does* look pretty much the same at first glance. But when a firm has been making wire mesh for 70 years man and boy, there's bound to be a little more to it than meets the eye — a little more know-how in engineering and weaving, a little more quality in the product, a little more service and satisfaction for the user.

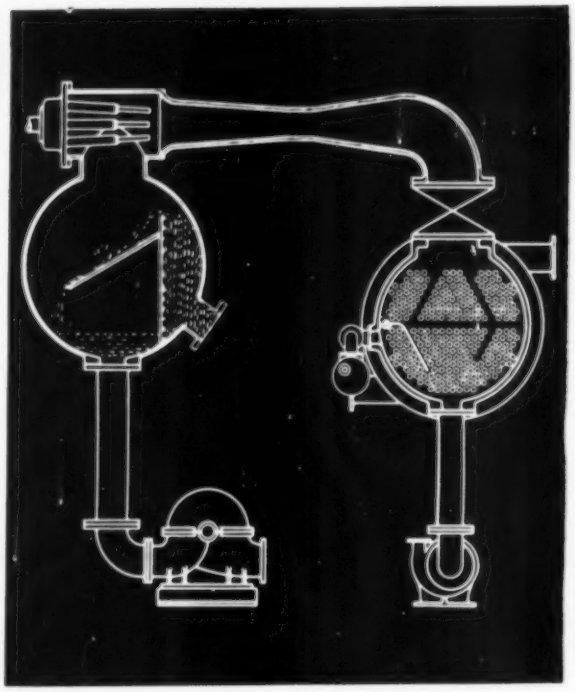
JELLIFF WIRE MESH is woven in all ductile metals
JELLIFF WIRE MESH is woven in all commercial weaves
JELLIFF WIRE MESH is woven in widths up to 72 inches
JELLIFF WIRE MESH is economical. Every foot runs true to the specifications.

★ ★ ★ ★

JELLIFF WIRE MESH is a quality product and has been for 70 years. You can depend on it.

Write today for full details about JELLIFF WIRE MESH, JELLIFF WIRE MESH PRODUCTS, and JELLIFF'S CONSULTATION SERVICE on wire-mesh engineering. Address Department 16.

THE C. O. JELLIFF MFG. CORP.
DIPPING BASKETS · LEAKPROOF RESISTANCE WIRE
WIRE MESH PARTS · WIRE CLOTH · STRAINERS · FILTERS
SOUTHPORT CONNECTICUT
SINCE 1860



Water cools itself with a C-R Chill-Vactor

A Chill-Vactor is a three-stage steam-jet vacuum unit which serves to flash-cool water and certain other liquids through temperatures down to 32° F. No chemical refrigerant is used. There are no moving parts. Water literally "cools itself" by partial evaporation at high vacuum. Vacuum refrigeration is usually less expensive than mechanical refrigeration in first cost as well as operating cost.

Chill-Vactors are producing chilled water in industrial plants throughout the world. They are cooling chemical solutions, fruit juices, milk, whiskey mash, etc. Bread and other baked goods have been vacuum cooled successfully for years. Other products, such as lettuce, spinach, celery and other leafy vegetables, are being cooled to temperatures around 33° F. in quantities up to 200 cars a day.

The Chill-Vactor is only one type of steam-jet Evactor manufactured by Croll-Reynolds. Let our technical staff help you with any or all of *your* vacuum problems.

CROLL-REYNOLDS CO., INC.
Main Office: 751 Central Avenue, Westfield, New Jersey
New York Office: 17 John Street, New York 38, N. Y.
CHILL-VACTORS · STEAM JET EVACTORS · CONDENSING EQUIPMENT

Sims

VALVES ARE GUARANTEED to last longer in any pump

HERE'S HOW...

Stem breakage eliminated – by exclusive double shock-absorber stem heads.
Reduced wear – long guide gives even lift. Springs can't jam.
Smooth seating surface – rotating valve disc changes to new seating surface with every pump stroke.
Reduced flow resistance – accomplished by Sims inclined seat-ribs.
Sims Pump Valves, for all reciprocating pumps, are stocked for quick delivery.

Write for Bulletin PR-1 explaining how Sims Valves can improve your pump operation at lower cost.

SP-104

SIMS PUMP VALVE CO., INC.
1314 PARK AVENUE, HOBOKEN, N. J.
M&M BLDG., HOUSTON, TEXAS

As **Management** Sees It . .

The Courts Say . . .

in recent insurance cases

Shelton

This column is to inform—not advise. It presents the current trend in legal thinking on insurance cases. The law varies from state to state and its application depends upon the facts of the particular case. Do not attempt to apply it without consulting your attorney.

JOSEPH M. SHELTON, Attorney-at-Law, Dallas

That intoxication bars, though started by employer.

EMPLOYER AND EMPLOYE had come to city on business of the employer. In the hotel that night the employer produced a bottle and both began drinking. After an extended evening, both were highly intoxicated. Somehow the employe fell from the seventh floor hotel room window and was killed. Insurance carrier said employe was not in the course of his employment because the injury was received while in a state of intoxication. Plaintiff said the defense of intoxication did not apply because the employer originated and participated in the drinking activities of the deceased.

The court said the Texas law is plain and unambiguous in declaring that an injury received while in a state of intoxication is not an injury sustained in the course of employment. The participation of the employer has no bearing on the situation.

—Smith et al v. Traders and General Ins. Co. 258 SW 2d 436 (Tex. Civ. App.—Eastland, 1953)

That unexplained death on job infers work accident.

DAY LABORER died within 15 or 20 minutes after starting work on a day which most lay witnesses called "very hot." Death certificate showed cause, "Cerebro Vascular Accident." Laborer's dependent contended this was caused by a heat stroke and asked compensation. Employer denied claim as not being an accident arising out of the employment.

The court said every reasonable doubt as to whether the act or injury of the employe arose out of the employment should be resolved in favor of the employe or dependent. There will be no compensation where cause of death is speculative, but where an employe is found dead at his post of labor, an inference arises that it was a work-connected accident. When such is the case, it is the burden of the employer to show it occurred otherwise.

Cunningham et al v. Hornbree, 257 SW 2d 12 (Tenn. Sup. Ct., 1953)

That injury resulting from a fight was compensable.

H—— was the aggressor in a fight which resulted from the accusation that W—— had stolen his pistol from his locker at work. W——, who suffered an eye injury, claimed that H——, a day worker, had the pistol in connection with his work. This was contended because H—— sometimes stayed at night to let trucks in and out and to see that the doors and windows were fastened. The employer urged that H—— wasn't required to have a pistol and he didn't know he had one; that the whole fight was a personal matter between the employes.

The court said it's reasonable to expect that an employe who is required to stay in a place of business would have a weapon for self-protection. There is, therefore, a connection between the conditions under which the work is required to be performed and the resulting injury and the injury is compensable.

—Jim Reed Chevrolet Co. et al v. Watson, 254 SW 2d 733 (Tenn. Sup. Ct., 1953)

PALMER

MERCURY ACTUATED

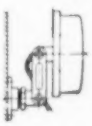
Dial Thermometers now in three types to suit any requirements

PATENTED

Full 4½" dial face. Stem can be placed at any angle and case can be rotated to any readable position.

1 **Rigid Stem Dial Thermometer** tapered bulb, interchangeable with standard industrial thermometer separable socket. (As illustrated above.)

2 **Wall Mounted Dial Thermometer** with flexible connecting armor. Case adjustable to easy reading position.



3 **Flush Mounted Dial Thermometer** for panel mounting with flexible connecting armor.

All three types have a full 4½" dial face.

for accuracy: Mercury actuated . . . Fully Compensated by Invar Compensaton. Guaranteed Accurate 1 scale division.

for angularity: Can be adjusted to most readable position at any angle desired.

for readability: Bold Black Numbers . . . 11" of scale Reading Dial face can always be placed in easiest readable position.

for interchangeability: Always specify "PALMER" Separable sockets as they are interchangeable for Dial or Industrial type Thermometers.

Send for Bulletin 51-129 for details on the New Palmer Dial Thermometer.

PALMER

THERMOMETERS, INC.

Norwood Ave., Cincinnati 12, Ohio

Mfrs. of Industrial Laboratory Recording and Dial Thermometers

As **Management** Sees It . . .

The Problem of Alcoholism in Industry

Only by bringing the disease out in the open can U. S. industry reduce a toll that has reached a staggering 352 million man-hours per year.

Bryce B. Reeve, M. D., Director of Medical Department, Standard Oil Company (Indiana)

RECOGNITION of alcoholism as a disease is the most important single factor in the recovery of millions of man-hours wasted each year by problem drinkers in industry.

The costs of alcoholism are staggering, but so much progress has been achieved in recovery that no industrial doctor should today be satisfied until he has tried to help the problem drinkers in his company.

Industry's stake is an estimated 352 million man-hours a year.

There are believed to be about 2 million problem drinkers in industry, and about 4 million in the nation. There is a yearly increase of about 250,000. The average yearly loss of time caused by alcoholism in industry is 22 days per alcoholic employe. It is estimated that alcoholism costs the city of Chicago alone $60 million a year. Neither the effects of inefficiency nor personal and family tragedies have been computed.

It's a Disease—Recognize It!

The control of any disease depends on bringing it out into the open.

This is as true of alcoholism as of diabetes, tuberculosis, the venereal diseases and smallpox, which have been brought under control only since public attention was focused on their treatment. Recognition of the problem is as necessary with alcoholism as with polio, heart disease, and cancer.

With industry awakened to the decisive role that health and welfare play in this problem among its employes, much more time and money than ever before are being devoted to the study of alcoholism, especially as it pertains to the problem of the uncontrolled drinker.

The alcoholic has perhaps best been defined as an individual for whom one drink is too much and a thousand not enough.

While the alcoholic problem is being approached from many angles, and no definite conclusion has yet been reached, almost everyone agrees that Alcoholics Anonymous is at present an important factor in its control. Drugs, psychiatric treatment, and other methods are also being used. Detailed information about the various treatments is available from a number of sources, notably the Yale Center of Alcohol Studies.

The first important step that a company can take toward control of the alcoholics in its employ is to get management to recognize that alcoholism is a disease, and that the individual alcoholic is a sick man who needs treatment as he does when he has any other illness.

Our present approach is to diagnose each case on a personal basis, and treat each according to the findings, as with any sick man. Our medical department is in close touch with Alcoholics Anonymous. When we discover an alcoholic, we get in touch with a member of the AA in our own company, and together we counsel with the alcoholic.

The Individual Must Cooperate

Again, recognition of his own problem is a key factor with the alcoholic himself. It is fundamental that the individual must come to recognize his own problem, face it, and want to do something about it. If the alcoholic is willing to accept help, we encourage him to work toward recovery through the AA program, and also to return to our doctor at any time for counsel.

Through this method we have been able to help many of our men not to drink—and to stay dry and well adjusted in their sobriety.

In our experience, recovery to sobriety has been achieved in about 75 percent of cases of alcoholism in which this method of referral and treatment have been possible. This experience covers some 5 years.

It is our present practice, if the man or woman is too sick to work and needs hospital care, to help the individual or his family arrange for it. In Chicago, the Portal House is an excellent institution to which such cases may be referred. Comparable treatment is available in many other cities.

If a problem drinker can be discovered early, will recognize his sickness, and will engage in control measures, he can be helped to avoid the progressive stages of alcoholism which lead to hospitalization. Too often in the past, and too often today because of lack of knowledge, fellow employes, supervisors, and foremen have shielded and protected the early alcoholic. Their motive has been fear that he would lose his job. They have not known how to approach the alcoholic in his incipient stage. The effect has been that ultimately the man reached the final stages of alcoholism where damage to his body was beyond repair and loss of his job inevitable.

Save Him—It's Worth It

The alcoholic is usually a very capable and intelligent empoye when away from alcohol. The loss of his services means a great deal to his company, and treatment resulting in his recovery represents a very real economic, as well as social gain.

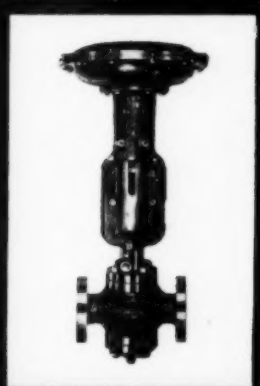
I am sure we do not know about all the cases of alcoholism among our own company employes. I am equally certain that as management comes more and more to recognize the importance of treatment and the high incidence of return to sobriety, the more successful we will be in our method of treatment.

The greater the effort put into this work, the greater the result.

The progressive oil industry should support the recent advances in combating alcoholism. It will take the combined efforts of the alcoholic, of his fellow employes, of supervisors and foremen, of management, of the industrial doctor, of the psychiatrist, of the research man, and of public health departments to make alcoholic control a success.

If our industry will accept the challenge of today's successes, I am certain that we can bring alcoholism under control. In doing so we can set an example for all industry to tip the scales toward successful relief of economic loss and human suffering.

for safe, easy stem lubrication



The isolating valve in the stem lubricator of the Honeywell Series 700 Valve affords maximum safety against leakage when replenishing stem lubricant . . . tight-fitting conical plug and machined seat assure leakless shut-off . . . pinned bonnet prevents accidental removal. The Honeywell Series 700 wide band proportional valve comes in a full range of styles and sizes . . . has *all* the features you look for in a fine valve. Write today for your copy of Bulletin 700-2.

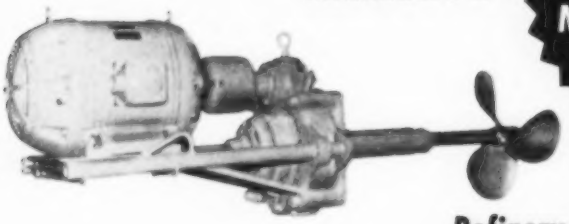
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1907 Windrim Avenue, Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
VALVE PRODUCTS

First in Controls

SJR SHORTSTIR Mixers

with NEW MECHANICAL SEAL



for Pipe Line, Process and Refinery fluid agitation

Where constant, reliable mixing is required – SHORTSTIR Mixers are the answer. Featuring a new stuffing box design **with mechanical seal and self-lubricating shaft bushing** – packing, packing leakage problems, and special lubricators are eliminated. For the utmost in mixer maintenance simplicity . . . **investigate SHORTSTIR – specify SHORTSTIR!**

SJR — SAWYER-JENSEN-ROSS CO.

BOX 3156 WHITTIER STATION TULSA 4, OKLAHOMA

Write TODAY for Catalog.

SALES REPRESENTATIVES:

HOUSTON — Peddlers, Inc. • **LOS ANGELES** — William J. Beckett Co. • **NEW YORK** — J. Arthur Moore Co. • **ODESSA** — W. L. Somners Co. **PITTSBURGH** — Kerr Engineered Sales Co. **SHREVEPORT** — W. L. Somners Co. • **TULSA** — Morvin Thomas Co.

FREE

For the first time in

Philadelphia

24TH EXPOSITION OF CHEMICAL INDUSTRIES

ESTABLISHED 1915

NOV. 30 to DEC. 5

COMMERCIAL MUSEUM AND CONVENTION HALL

See almost 500 exhibits conveniently located on one floor, representing all phases of the chemical industries. Chemical engineers, chemists and skilled technical men will be on hand to offer the latest information and practical solutions to your processing production problems. See and compare methods, materials, equipment, processes and techniques that will affect future trends in the chemical processing industries.

Acquire in a matter of days factual information it would take you months to accumulate. For 38 years this great exposition has exerted a vital progressive influence in the increasingly important field of chemical processing. PLAN NOW TO ATTEND.

Application forms for hotel accommodations are available by writing to

INTERNATIONAL EXPOSITION COMPANY • 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

As **Management** Sees It . . .

PRESS RELATIONS

Continued from Page 93

"We simply don't have the time," said a major company representative, "to be a handout bureau for trade papers, miscellaneous publications, and the daily press. And if we did, it would be an impossible job because of the necessity of slanting every story according to the geographical interests of each paper and the policies of each managing editor. The only solution is for us to act as an information center. We will dig up the answers to any reasonable question, but we simply can't write reams of stories."

Said another PR director: ". . . it is essential that a public relations department cooperate with press representatives and give them in every way possible the information they seek.

"One basic tenet of ours is to release only stories that are actually newsworthy."

And another: ". . . we maintain a press contact service where the press can secure information promptly about our corporation activities, and any information about the oil industry generally which they might need. We try to be friendly and readily available.

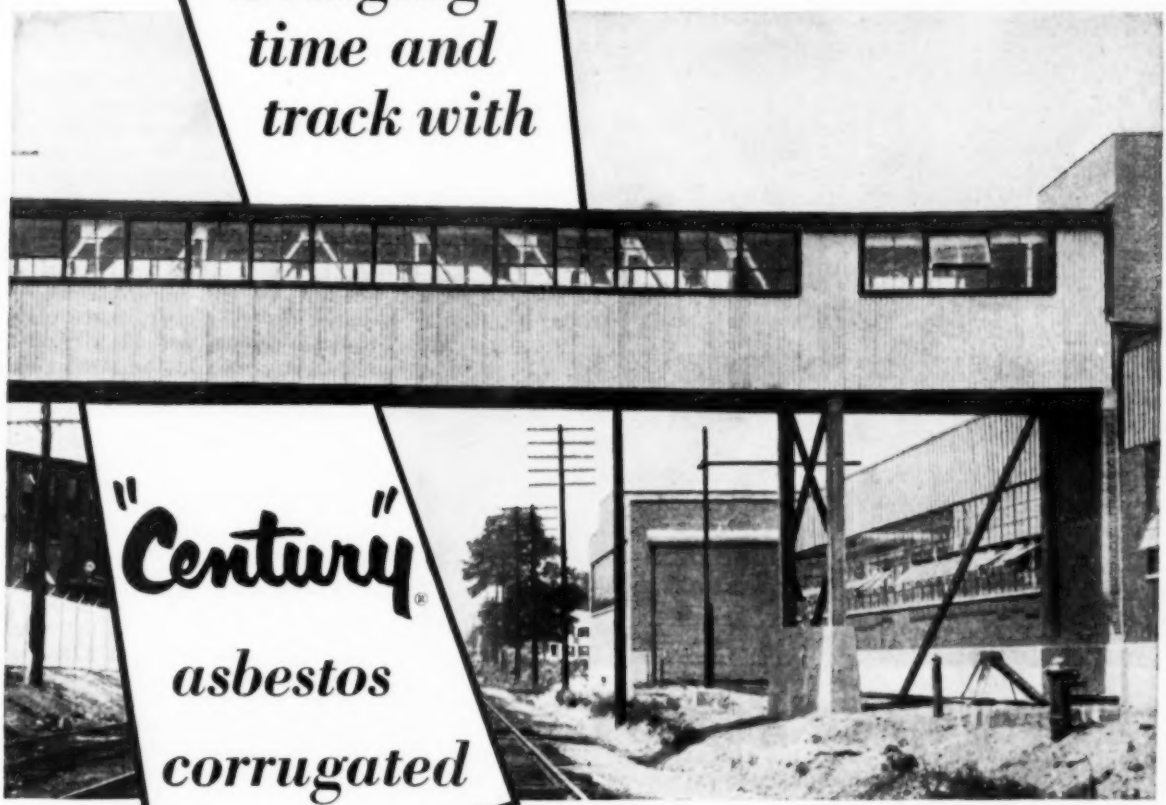
"In cases where we know that any of our activities are newsworthy, we prepare news releases and send them out to those who will find the information useful."

And another: "We confine our releases to items which we feel have both news value and reader interest. In addition, we cooperate with the press by answering inquiries as fully and as promptly as possible."

More emphasis is placed on news handouts during such occasions as Oil Progress Week. These observances also call for special services. For instance, it is the policy of Standard Oil Company of California, as part of its participation in Oil Progress Week, to fly newspapermen from outlying points to its refineries. "We try to get as many as we can of the editors or staff members of the smaller papers, because they are overlooked so frequently in affairs of this kind." This year, California Standard planned to bring about 40 Washington and Oregon press and radio representatives to the Richmond refinery, and another 20 from eastern Washington and Idaho to the Salt Lake refinery.

Disaster Procedures—Intense and unusual efforts are also made in the aftermath of an explosion, fire, or the like. Such an emergency sets off a fury of defensive activity—defensive because the industry realizes that re-

Bridging time and track with



"Century"® asbestos corrugated

Inter-plant bridge of the Trumbull Electric Department of the General Electric Co. in Plainville, Conn. Sidewalls of bridge and the building on the right constructed of "Century" Asbestos Corrugated, and applied by Hampden Cornice Works Inc., Springfield, Mass. Supervisor of Construction: General Electric Realty Corp., Schenectady, N.Y. Engineer and Architect: Lockwood Greene Engineers Inc., New York, N.Y. General Contractor: The Gellatly Construction Co., Bridgeport, Conn.

"Century" Asbestos Corrugated makes an ideal siding for this new inter-plant bridge and building because of its outstanding durability and freedom from maintenance. After many years this long-lived siding will still be sound, serviceable, and weather-tight.

If that's the kind of dependable siding and roofing *you* are seeking, you ought to know more of the many advantages in using "Century" Asbestos Corrugated. Here are a few facts about this versatile, economical material:

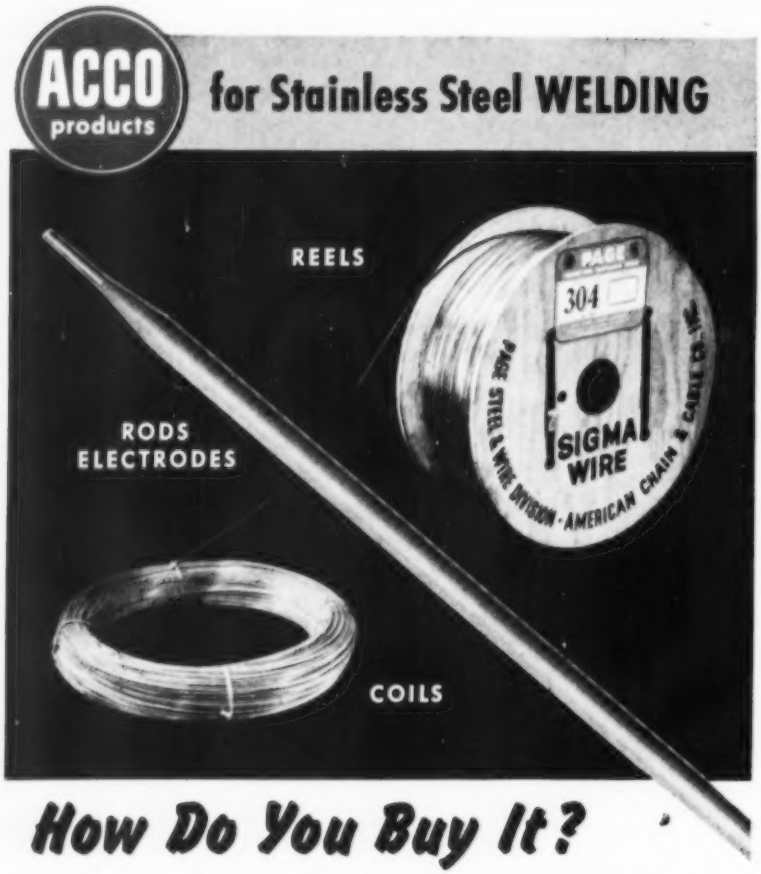
It is made in large, strong sheets from portland cement and asbestos fiber—therefore *cannot* burn, rot or rust. It is impervious to rodents and termites. It is completely, permanently weatherproof. Although it never needs paint, it will take decorative colors well.

"Century" Asbestos Corrugated has proved itself to be a maintenance-free and long-lasting building material—well worth your close consideration. We shall gladly send you complete information on request.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873.

K&M Expert in asbestos

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA



How Do You Buy It?

• No matter how you buy stainless steel welding wire—on reels, in coils, or packages of rods or electrodes—PAGE can supply you in a variety of analyses.

AC-DC Electrodes—Gas Welding Rods

Stable burning even at lower heats. Slag is clean and easily removed. Coating resists cracking right down to short stubs. Your choice from a complete line for every type of stainless welding.

for Inert Gas Welding

Six Page-Allegheny stainless grades in .035", .045", and .0625" diameters. Precision thread-wound on 25-lb. non-returnable reels to fit popular arc welding machines.

for Submerged Arc Welding

PAGE stainless in wire diameters from 1/32" to 5/16", plain or copper coated. In layer-wound coils, 22" or 24" mill coils, or 200-lb. returnable steel reels.

Write our Monessen, Pennsylvania office for literature and prices

ACCO

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE Welding Electrodes Rods Wire

As **Management** Sees It.

porters have a job to do, and frequently it's up to the company involved whether they do the job right or foul their front pages with harmful exaggerations.

Every PR man knows this. Said one: ". . . industrial accidents and injuries are items of legitimate news value, and as such should not be suppressed. It is a newspaper man's job to report the news and, like anyone else who is conscientious about his work, he will use whatever legitimate means are available to get his job done. In case of an accident he will go to the logical source, but if he can't get the information he wants there he will get it some place else. In the case of our company we want to give him the information ourselves."

Some companies have learned this lesson only after considerable pain. One PR man recalled that "Another oil company in this area had a disaster and as a result of what appeared to be a rather unfortunate attitude toward the press, one might say that the company came out second best in the reporting. I do not mean to imply that the reporting was purposely slanted, but the men assigned to the story could not get all of the facts and as a result had to write their stories on the few facts they could dig up. This resulted in some unfortunate deductions on the part of the readers.

"Our manufacturing men realized the shortcomings of such a situation and determined to devise a 'disaster' procedure."

Many formal disaster procedures in the industry are similar to Union Oil's, which points out that "The reporter comes to you for one reason—to get the story. Give him all the facts you can, unhesitatingly and accurately. If you can't answer his questions, admit you don't know. We want the press to know that Union Oil will supply them with uncolored, genuine news as clearly and as quickly as it knows how.

"CAUSE OF THE EMERGENCY? Very possibly the cause is not definitely established. If it is not, don't guess and don't give out 'cause' information until it is definitely established. Tell the reporters frankly that as soon as all the facts are known they will be told. Then see that they are told. Do not suggest 'possible' causes, as often they prove later to be wrong.

"ESTIMATE OF DAMAGE? Give as accurate an estimate as possible, based on your knowledge of the operations and equipment. Some reporters under the emotional excitement and need for reporting the story rapidly

may be apt to give an exaggerated estimate rather than a conservative one. Help them to report its closer relationship to actual facts.

"CASUALTIES? A brief but accurate statement regarding any injured or dead persons should be willingly furnished the press. This is a situation where correct names and initials and addresses (if possible) are of the utmost importance.

"LIABILITY? It is wise to restrain comment on such matters. The liability of the company, if associated with a disaster, involves many legal and technical factors.

"PHOTOGRAPHS? Admit photographers to any scene they feel is newsworthy. Give them full cooperation. It is wise, however, to check the credentials of the photographers to be sure they are with recognized publications or news services."

Fixing Responsibility—Many large companies use generalized disaster procedures as a stop-gap measure pending the arrival at the trouble site of qualified spokesmen. One West Coast refinery has set up a list of employes authorized to aid press, radio and television during emergencies. Chosen because of their knowledge of the various installations, every man listed is equipped to give quick and correct information on (a) the nature of the emergency; (b) the cause of the emergency; (c) the extent of the damage and a conservative estimate of property loss; (d) the nature and extent of injuries to personnel; and (e) an estimate of the time required to restore normal operations.

Another company details for its employes the proper procedure for handling the press immediately after emergencies, then adds: "A member of the Public Relations staff will be sent to the scene of major emergencies as quickly as possible and he will directly assist the division manager or others in charge of coordinating the information required and releasing it."

Less spectacular but no less important than these emergency procedures are day-to-day press relations. These will succeed or fail to th degree that industry applied a creed which one PR man expressed like this:

"We believe the press has a right to know what we are doing and, as long as we do not give away a competitive advantage, we should supply the information they seek. If our 'good citizenship' is a fact and not just an idealistic wish of the management, this information should help us attain our basic objective."

Here's PATTERSON Practicality!

PATTERSON Outside Packed SIDE ENTERING AGITATORS

Repack while running— no lost running time

A unique method—a unique advantage—thanks to Patterson ultra-modern design! No special tools required—any handyman can change packing while agitator is in full operation. Send for full details on these versatile, dependable Patterson Agitators that handle so many jobs—**so well**—in the refining field today!

Richard L. Conway

The Patterson Foundry and Machine Company
East Liverpool, Ohio, U. S. A.
NEW YORK BOSTON BALTIMORE PHILADELPHIA PITTSBURGH DETROIT CINCINNATI CHICAGO ST. LOUIS HOUSTON DENVER LOS ANGELES SAN FRANCISCO SEATTLE
The Patterson Foundry and Machine Company, (Canada) Limited
Toronto, Canada
MONTREAL

What **Suppliers** Are Doing . . .

S. Morgan Smith Company Appoints David Hopkins Chief Consultant

David W. Hopkins, executive vice president of R-S Products Corporation, Philadelphia, has been appointed chief consultant for the Valve division of S. Morgan Smith Company, of which R-S Products is a subsidiary. Hopkins will be assigned to the Valve division's Philadelphia and York, Pa., offices.

Hopkins

S. Morgan Smith Company is the largest manufacturer of hydraulic turbines in the country, with a sales volume last year of between $20 million and $24 million.

Lunkenheimer Announces Expansion Of Valve Production Facilities

Facilities for producing steel and iron valves at its Carthage, Ohio, plant are being expanded, according to P. M. Arnall, president of The Lunkenheimer Co.

Steel and iron castings will be supplied to Lunkenheimer specifications by outside sources, which "necessitates adjustment in the foundry working force and allows Lunkenheimer personnel to devote their full time and efforts to the production of steel and iron valves."

Fire Protection Service Firm Formed by Experienced "Firemen"

U. S. Fire Protection Engineering Service, Inc., is a new organization formed by a group of experienced fire prevention and fire protection engineers to assist management in economically solving problems of safeguarding life and property from fire destruction. It is headquartered at Kansas City, Mo., with facilities to handle work throughout the country. It has no connection with any insurance company, equipment manufacturer, or construction contractor, company officials report.

Objective of the company is to assist clients in achieving and maintaining a fire-safe and economically-insurable operation. Services of the company will supplement existing fire protection engineering departments and insurance inspection services or fulfill those needs in organizations where they do not exist.

Frank H. Gage is president of the organization.

Loosli to Head Calco Market Research and Development Unit

Alden R. Loosli has been named manager of the newly formed Market Research and Development department at Calco Chemical Division of American Cyanamid Company in Bound Brook. Loosli will also continue in his present post as assistant to the general manager.

Wiley W. Carr will continue in his position of manager of the market research section of the new department.

Frame Succeeds Adams as Director Of U. S. Steel Division Research

Appointment of William M. Frame as director of research and technology has been announced by United States Steel Corporation's National Tube division. Frame will succeed O. P. Adams, who is retiring.

Frame

Since joining U. S. Steel's National Tube division in 1952, Frame has been executive assistant, operating department. He began his career in the steel industry as a metallurgical engineer for Central Alloy Steel Company at Massillon, Ohio, in 1928.

Adams started with U. S. Steel in 1929 as superintendent, Mechanical Power, at National Tube Division's National Works, McKeesport, Pa. Two years ago he was appointed director of research and technology.

Rockwell Sales Engineers Take Natural Gas Refresher Courses

Two Rockwell Manufacturing Company sales engineers recently completed courses in natural gas transmission and distribution at the Institute of Gas Technology, Chicago, "in line with the company's expanding sales education program."

The two are Harry J. Schneider of the firm's New York district office and Harry Moore of the Columbus, Ohio, office.

The refresher courses are planned to

Why Buy A 36" Bubble Tower?

when a 18" to 24" column may do the job.

YOU ARE LOOKING through an inspection opening in the side of a column showing the cellular construction of Multi-Path tray packing.

MULTI-PATH TRAY PACKING is a high capacity column internal construction which eliminates channeling and gives high efficiency regardless of how large the column may be. Its capacity and H.E.T.P. characteristics permit large reductions in the dimensions of the column.

It is suited for fractionators, absorbers, strippers, and gas scrubbers in refineries, petrochemical plants and gasoline plants. Either carbon steel or alloy construction can be furnished, and it is easily intalled in new or existing columns. Why not investigate it?

Write for folder

FRACTIONATING TOWERS, INC.
211 West 12th St. - New York 11, N. Y.

HOW'S YOUR STORAGE PICTURE?

If increased production is causing a storage problem, now is the time to let Dollinger help you. Buildings fabricated to your design requirements are a Dollinger specialty.

But that isn't all. Dollinger will supply structural steel for practically all your building needs. So if you are planning additional storage space, office buildings or additional plant facilities, call or write today.

FOR OVER 50 YEARS, LEADERS IN THE PETRO-CHEMICAL INDUSTRY HAVE LOOKED TO JOHN DOLLINGER, JR., INC. FOR QUALITY STEEL FABRICATION AND DEPENDABLE DELIVERY.

DOLLINGER AROUND THE WORLD.

For inquiries regarding fabricated structural steel and plate steel, write to John Dollinger, Jr., Inc., Beaumont, Texas.

familiarize gas engineers with current industry problems and practices. This is the second year that Rockwell representatives have attended.

Frank C. Edwards Named New Head of P&H Diesel Division

Harnischfeger Corporation, Milwaukee, has named Frank C. Edwards general manager of the P&H Diesel Engine division in Crystal Lake.

Edwards

Edwards' entire business career has been spent with Harnischfeger Corporation, his first employment being in the Milwaukee shops in 1925. Since that time, he has been in Memphis, New York, Jacksonville and Pittsburgh district offices. He also was general manager of the company's former Truck Crane plant in Newark, N. J.—the manufacturing operation which preceded the company's present plant in Escanaba, Mich. For the past four years, he has held the position of sales manager of P&H's Small Excavator division.

Edwards is a graduate of the University of Nebraska.

Russ Appointed General Manager In U. S. Rubber Division Changes

The Sales department of United States Rubber Company's International division has been reorganized under the direction of a general sales manager and six managers.

G. J. Russ has been appointed to the newly created post of general sales manager, and will be responsible for all sales activities. He will also integrate the department activities with those of staff departments and other divisions of the company.

Other new positions, and the men appointed to them are: manager of branch sales, A. N. Reeves; manager of distributor sales, R. J. Thomas; manager of head office sales and government sales, A. Eaton-Clarke; and manager of product departments, W. J. Mulvihill, Jr. J. T. Kuntz continues as manager of sales development, and H. L. Reynolds as manager of sales operating.

Scovill Company Puts Aluminum Strip Mill Into Production

Scovill Manufacturing Company's new aluminum strip mill is now in production at Waterbury, Conn.

One of the innovations introduced in the new mill is the use of furnaces, the first of their type, whereby all aluminum production is annealed under complete atmospheric control with a substitution of nitrogen for oxygen.

The cold-rolled aluminum strip will be marketed under the name of "Truspec."

Dorflinger Receives Promotion At Fischer & Porter Company

Fischer & Porter Company has promoted Glen Dorflinger to a district manager for the sale of its process control instruments in Houston. The company's Houston district office has been enlarged by the addition of Harry Ogden and James B. Cochran to its sales and service group.

Arizona Chemical Promotes Scharwachter to Vice President

Arizona Chemical Company has announced the election of Albert Scharwachter as vice president. He has been sales manager for the concern for several years.

Scharwachter had been associated with Klipstein & Company, a chemical firm, for many years before it was acquired by American Cyanamid Company, which owns Arizona jointly with International Paper Company.

Recently reelected president of the Tall Oil Association, Scharwachter is a member of the Industrial Oils Industry Advisory Committee of the Production and Marketing Administration of the U. S. Department of Agriculture.

U. S. Steel Division Announces Three Mid-Continent Area Shifts

Three appointments have been announced by United States Steel Corporation's Oil Well Supply Division for the Mid-Continent area.

Fred R. Luther, formerly in the "Oilwell" stores at Wewoka and Duncan, Okla., has been named manager of the "Oilwell" store at Elk City, Okla., succeeding D. E. Richeson, who has been transferred to the Oklahoma City store as field representative. John A. Fisher, formerly in the Rocky Mountain area, has been named area manager, machinery sales, and will headquarter in Tulsa.

Luther joined "Oilwell" in February, 1950. Richeson has been with the division since February, 1948, and Fisher,

ARCCO
ARCCO CANNON NEVER-DRY PEN
Writes for Months
REPLACES OTHER MAKES • USES REGULAR INKS
Regardless of pulsations or other causes of ink failures this new Never-Dry Pen will make clean and complete records. Ink supply lasts for several months without refilling reservoir. Capillary tube from ink bottle placed in instrument case feeds pen with continuous flow. Closed system sealed from atmosphere prevents clogging and dirt accumulation.
Weight of pen is constant at all times thus insuring extreme accuracy. No slopping or dripping. Stainless steel construction—no corrosion. When ordering, specify make and type of recording instrument.
AMERICAN
RECORDING CHART CO.
3113 E. 11th St. • Los Angeles 23, Calif.
$6.00 each Net
Send for quantity prices
SEND FOR BULLETIN NO. 110

JET-LUBE
KOPR-KOTE
THREAD LUBRICANT and SEAL

HEAT RESISTANT

Avoid leaks in casing and tubing with JET-LUBE's high temperature KOPR-KOTE. Contains fine ground metallic copper. Hundreds of wells cased and tubed without a "leaker." Batch controlled. Fully guaranteed.

Order through your supply store or send for complete details

JET-LUBE INC.

7362 W. BEVERLY BLVD., LOS ANGELES 36

Headquarters for
PETROLEUM TESTING EQUIPMENT
used by

- REFINERIES
- PETROCHEMICAL PLANTS
- GASOLINE PLANTS

W. H. CURTIN & CO.
DOMESTIC EXPORT
LABORATORY APPARATUS & CHEMICALS
HOUSTON · NEW ORLEANS
TULSA · BIRMINGHAM · USA

who was area manager of machinery sales at Houston and Casper, Wyo., before his appointment, joined "Oilwell" in April, 1927.

Blaw-Knox Appoints M. R. Wingard Sales Engineer for Tulsa Area

The Chemical Plants division of Blaw-Knox Company has appointed M. R. Wingard sales engineer. Wingard will be located at the Western headquarters in Tulsa, Oklahoma, and will offer the company's processes and engineering construction services to chemical, petrochemical, and industrial clients in a nine-state area.

M. R. Wingard

Wingard, a chemical engineer, is a graduate of the University of Akron and has done graduate work at the University of Michigan. He is a member of the American Chemical Society and the American Institute of Chemical Engineers.

Enjay Company Adds Two to Paramins Sales Division Staff

Joseph L. McGinniss and George Horning Lowden formerly with Standard Oil Development Company, central technical organization of Standard Oil Company (New Jersey) affiliate, have been named to the Paramins Sales division of Enjay Company, Inc.

McGinniss joined Standard Oil Development in 1940 in the Research division. Since 1946 he has been engaged in engine test work on fuels and lubricants and on aviation synthetic lubricants for jet engines.

Lowden, who started with Jersey Standard in 1948, for the past five years has served as technical advisor providing sales engineering services to Jersey Standard overseas affiliates on all types of petroleum products.

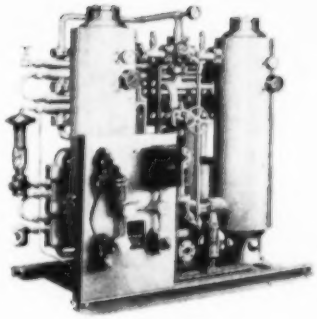
Minneapolis-Honeywell Opens New Dallas Office-Warehouse

A new 13,000-square-foot sales office and warehouse has been opened in Dallas, Texas, by Minneapolis-Honeywell Regulator Company. It will house the company's Southwestern regional office which serves Texas, Oklahoma, Kansas and parts of Louisiana, Mississippi, Arkansas, Missouri and New Mexico. It will also be headquarters for Honeywell's branch sales office serving northern Texas and northern Louisiana.

The one-story structure was built by McFadden & Miller, general contractors, Dallas. Fred C. Brandt is Honeywell's Dallas regional manager.

Pyrene Air Foam Systems Now Sold and Installed by Grinnell

Air foam fire extinguishing systems designed and manufactured by the Pyrene Manufacturing Company, Newark, N. J., are now offered for sale and installation through the nationwide organization of Grinnell Company, Inc. The non-exclusive arrangement with Grinnell does not alter the sale of Pyrene air foam systems, mobile and portable equipment through Pyrene's own district offices and air foam jobbers.



This is a Pritchard HYDRYER—the choice of critical buyers in the petrochemical industry for* efficient, dependable *dehydration!*

This quality packaged unit promises long, trouble-free operation in drying compressed air and other gases for instrument and process controls. Adsorbents are carefully selected for your drying requirements. Completely factory assembled. Custom units designed for any special need. To cut dehydration costs, contact Pritchard today.

* Registered Trade Name

Industry's Partner for Progress

J. F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS
MANUFACTURERS

Dept. 307, 210 West 10th St.,
Kansas City 5, Mo.

COOLING TOWERS • SPECIALIZED HEAT EXCHANGERS
GAS AND AIR TREATING EQUIPMENT • CONSTRUCTION
AND PROCESSING FACILITIES

Republic Steel Appoints Bole Assistant Division Sales Manager

Joseph K. Bole, Jr., has been appointed assistant manager of sales of the Bolt and Nut division of Republic Steel Corporation. He was formerly assistant district manager of Republic's Washington, D. C., office.

Boles

Bole has been with Republic and predecessor companies since 1928, concentrating on sales during most of this period. As a salesman he has represented Republic in Indianapolis, Philadelphia, Detroit and Cleveland. Herbert D. Burdick, an assistant manager of sales of the Bolt and Nut division, will continue in that capacity.

Brungraber and Trinkle Shifted In Bigelow-Liptak Changes

L. E. Brungraber, formerly at the New York office of Bigelow-Liptak Corporation, has been moved to Philadelphia, and Arthur H. Trinkle has been transferred from Detroit to New York in personnel changes announced by the company.

Brungraber, who worked for several years in the engineering and sales offices in Detroit, will represent the company in the Philadelphia area. Trinkle will handle sales of B-L products in northern New York. Trinkle was formerly employed by Stone and Webster Engineering Company, Foster-Wheeler Corporation, and for the Laclede-Christy Arch Division. Both men will be under the general supervision of V. P. Johnson, manager of the New York office.

Plastics Production Laboratory Established at Midland by Dow

A Plastics Production Laboratory has been established at the Midland Division of The Dow Chemical Company, and will be operated under the supervision of Dr. W. H. Schuette, manager of Plastics Production. J. Lawrence Amos will be laboratory director and A. F. Roche, assistant director. Both formerly were with the Physical Research Laboratory.

The laboratory's activities will include the improvement of existing products and processes of the Plastics Production section and the development of new products and processes.

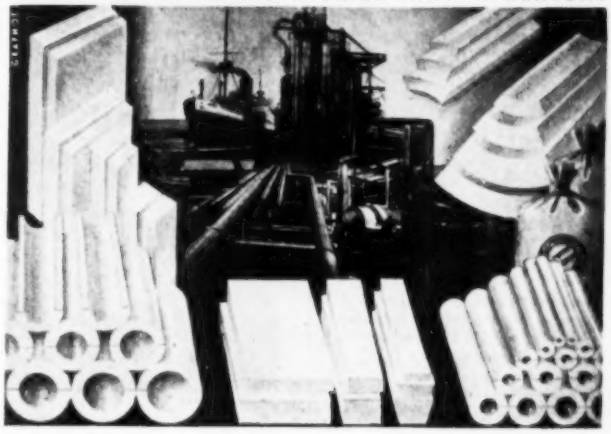
United States Gasket Represented By Buchanan Company in Houston

With the dissolution of Rowan and Buchanan, former representatives of United States Gasket Company in the Houston area, United States Gasket has announced it will continue with the newly formed Wm. C. Buchanan Company of 4101 San Jacinto Street, Houston.

Owens-Corning Appoints Bosley Petroleum Industry Specialist

Samuel E. Bosley, for five years Tulsa branch manager of Owens-Corning Fiberglas Corporation, has been named petroleum industry specialist by the company. He will serve the industry in applying his knowledge of the application of Fiberglas products to problems

INSULATION SPECIALISTS SINCE HALF A CENTURY



We supply the material and the men to handle it.
Contractors for heat and cold insulation all over the world.
Suppliers and exporters of all kinds of insulation materials for oil refineries a.o.

Magnesia 85 % - Rockwool - Asbestos - Cork

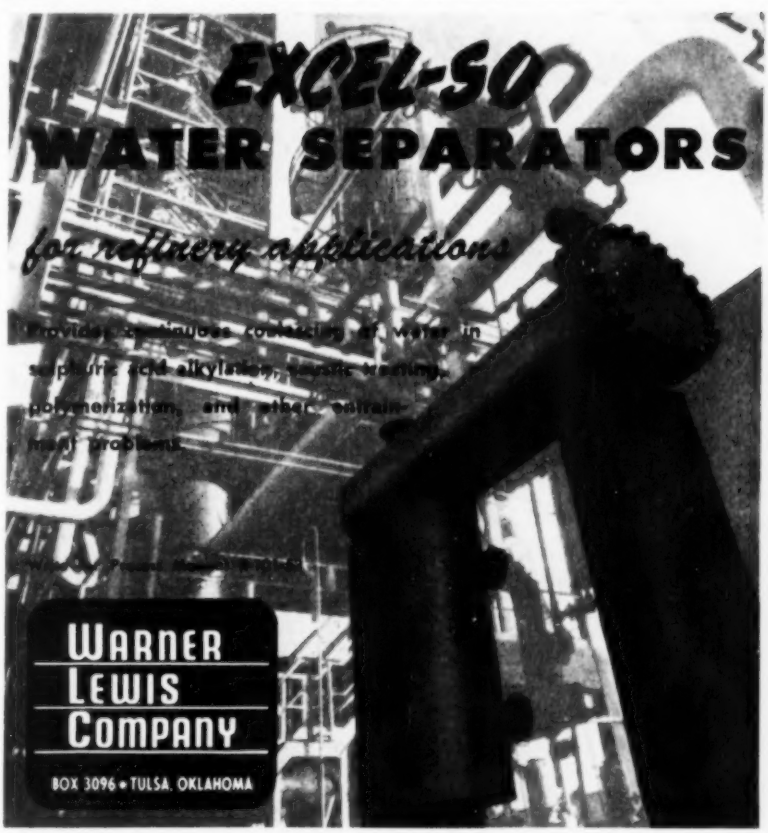
For all temperatures, in sections, blocks, segments, sheets, blankets and plastic form.

All finishing materials.

INTERNATIONAL TECHNICAL TRADING COMPANY **CLETON LTD.**

SCHIEDAM - NETHERLANDS

cable address Cletontrading



NATIONAL AIROIL
FUEL OIL - GAS
BURNERS
SERVING INDUSTRY FOR 41 YEARS

- Steam Atomizing Oil Burners
- Mechanical Atomizing Oil Burners
- Low Air Pressure Oil Burners
- Rotary Oil Burners
- Industrial Gas Burners
- Combination Gas and Oil Burners
- Tandem Block Combination Units
- Fuel Oil Pump Sets
- Refractory Burner and Muffle Blocks
- Valves, Strainers, Furnace Windows

Detailed information gladly sent you upon request.

Established 1912 — Incorporated 1917

NATIONAL AIROIL BURNER COMPANY, INC.
1254 East Sedgley Ave., Philadelphia 34, Pa.
Southwestern Division: 2512 So. Blvd., Houston 6, Tex.

Remember ENCOA

for Special Mechanical and Process Equipment

ENCOA offers a complete engineering service operating under the direction of experienced and skilled Engineers and Designers.

Send for our Brochure of Photographs, "One Picture Is Worth A Thousand Words" illustrating many examples of unique equipment already supplied by by ENCOA.

ENGINEERING CORPORATION OF AMERICA
100 Quimby St., Westfield, N. J.

Conoflow Representatives Gather—

Manufacturers representatives of Conoflow Corporation attending a recent sales-engineering conference in Philadelphia were:

Standing, left to right: Donald Davie, H. H. Barnum Company; Paul Henke, National Engineering Company; David Hall, W. M. Wilson Company; James B. Madison, Conoflow; Morley Hudson, Hudson-Rush Company; M. Mark Watkins, Conoflow. Seated, back row: O. D. McEnderfer, King Gage Engineering Company; Eugene Leeland, Instrument Sales Company; Bernard Bremmer, H. G. Jones Company; Bruce Greaves, Bruce Greaves Company; Glynn Thomas, Equipment Sales Company; C. P. Boyd, Cyberno Products Company. Front row: Al Hatcher, O. R. Lawrence Company; Jack Lawrence, O. R. Lawrence Company; Jack Rush, Hudson-Rush Company; Roy Meyers, E. Roy Meyers Company.

The conference was under the direction of John C. Koch, vice president in charge of sales at Conoflow.

of corrosion, filtration, heat control and other processes.

Bosley, who will maintain residence in Tulsa, joined Owens-Corning in 1946.

Loosli to Head New Department Of American Cyanamid Division

Alden R. Loosli has been named manager of the newly formed Market Research and Development department at Calco Chemical division of American Cyanamid Company in Bound Brook, N. J. Loosli will also continue in his present post of assistant to the general manager.

The new department which will include the existing Market Research department will conduct market surveys and make economic studies for new products and their uses, and proposed expansion of established products, and promote initial sales of new products requiring market exploration. Wiley W. Carr will continue in his position of manager of the market research section of the new department.

Alco Names James H. McGraw

James H. McGraw, Jr., has been named a director of American Locomotive Company.

McGraw was for 25 years chief executive officer of McGraw-Hill Publishing Company, as well as a former director and national vice president of the National Association of Manufacturers. He is presently a member of the Business Advisory Council of the Department of Commerce.

Lummus Fills Foreign Sales Post

Roger M. Serre has been appointed assistant to the vice president in charge of Foreign Operations at The Lummus Company. He will be concerned with foreign sales.

Denton Made Marketing Manager At Weston Electrical Instrument

Appointment of Charles B. Denton as marketing manager has been announced by the Weston Electrical Instrument Corporation.

Denton

In this newly created post, Denton retains direction of the Advertising department and also assumes responsibility for the sale of all retail and distributor products. He joined the company in 1925.

Rockwell Manufacturing Adds Dean As Employe Training Supervisor

Richard F. Dean has been appointed supervisor of Rockwell Manufacturing Company's employee relations and training program. Dean was formerly assistant to the training director in the Central staff of the Industrial Relations department of Koppers Company, Inc. Before joining Koppers, he served as special consultant to industries and business organizations in New York. In his new post he will work on the staff of E. F. Foubert, manager of industrial relations.

Corcoran Joins Crosby Valve

James L. Corcoran has joined Crosby Steam Gage & Valve Company and The Ashton Valve Company as director of engineering. Corcoran, connected with the safety and relief valve industry since 1934, is a graduate of Purdue University, holding both a BS and MS degree in mechanical engineering.

BS&B Announces Election of Siver To Executive Engineering Post

Election of Chester A. Siver as vice president and general manager of Engineering has been announced by Black, Sivalls & Bryson, Inc. He has been with the BS&B organization since early this year as general manager of engineering, with company wide supervision of engineering activities and engineering staffs. For many years he was associated with Linde-Air Products Company. More recently he was manager of engineering of The Liquid Carbonic Corporation, Durable Goods division. His offices are at the company's general offices at Kansas City, Mo.

Siver

Heads Chemicals and Rubber Unit in New Commerce Agency

Norman E. Hathaway, sales manager of the industrial chemicals department of The Davison Chemical Corporation, Baltimore, has been granted a six months' leave of absence to serve as director of the chemicals and rubber division of the chemical, rubber and forest products bureau in the successor agency to the National Production Authority which is being organized by the Department of Commerce.

Hathaway

In his absence from Davison, his duties there will be assumed by David P. Barrett, assistant sales manager of the industrial chemicals department.

A 1942 graduate in chemical engineering of the University of Maryland, Hathaway came to Davison in 1946.

Warner Elected Board Chairman Of Precision Scientific Company

Precision Scientific Company, Chicago, has elected Chester A. Warner chairman of the board and John J. Kinsella to succeed him as president. Warner was elected to fill the vacancy caused by the recent death of Walter W. Pitann, founder and chairman of the board.

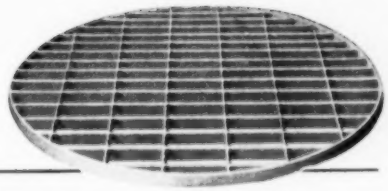
Other elections made Arthur Pitann vice president and secretary to fill the position vacated by Kinsella. At the same meeting, the board appointed George E. Bader and Edmund E. Tice vice president in charge of manufacturing and vice president in charge of finances, respectively.

Thomas and Utnehmer Given Babcock & Wilcox Promotions

William J. Thomas has been appointed general manager of the Tubular Products division of The Babcock & Wilcox Company and Paul J. Utnehmer, works manager, has been named to the board of directors of the division.

Thomas, who has been with B&W

REMOVE THE DANGER OF OPEN AREAS



Here's the Solution!

Blaw-Knox Electroforged Steel Grating is the ideal "coverage" for unprotected pits, light wells, basement stairways and other hazardous open areas. It is a one-piece steel "material" that provides safe footing under any conditions, and admits the maximum of light and air. *Strong . . . Silent . . . Secure.* Thousands of installations are still on the job after 20 years of traffic!

Send us dimensional sketch

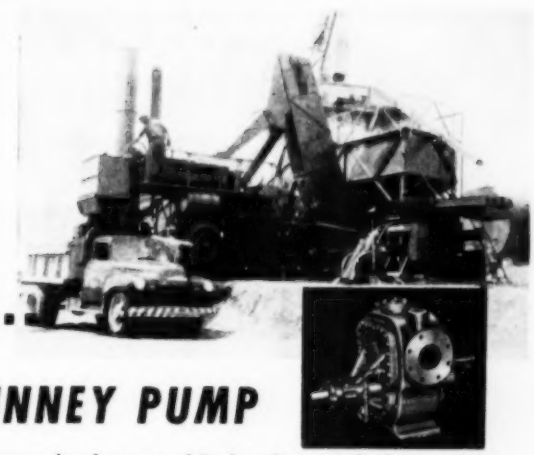
We will then forward you price on grating cut to exact size. No nuts, no bolts, no special tools required. Don't delay . . . write today and make those danger spots both safe and usable!

BLAW-KNOX COMPANY
Grating Department
BLAW-KNOX EQUIPMENT DIVISION
2005 Farmers Bank Building
Pittsburgh 22, Pa.
STerling 1-2700

ELECTROFORGED® STEEL

BLAW-KNOX GRATING

BIG HOT MIX PLANT..



...uses KINNEY PUMP

One of the many quality features of Barber-Greene's high capacity hot mix plant Model 848 is its Kinney Model SD Asphalt Pump. Even when producing 120 tons of mix per hour, the positive displacement, meter-like accuracy of the Kinney Pump helps insure correct proportion of bitumen to aggregate.

Kinney SD Pumps available in capacities from 2 to 3,000 GPM — steam-jacketed in most sizes. Send for Kinney Bulletin L-51 describing complete line. Kinney Manufacturing Co., 3596 Washington St., Boston 30, Mass.—manufacturers of liquid and vacuum pumps. Representatives in principal cities of United States and foreign countries.

SUBSIDIARY OF THE NEW YORK AIR BRAKE CO.
Kinney

has
coil-itis*
got you
constantly
doctoring
your
tanks?

Like the human appendix, pipe coils often give constant trouble until they are removed and replaced with Platecoils. Immediately, you will notice the difference as Platecoils put new life and profits into your heat transfer processes. They heat or cool 50% faster. They take 50% less space in the tank leaving room for greater payload. Platecoils overcome the limitations and operating difficulties of old fashioned and outmoded pipe coils to save hours of downtime.

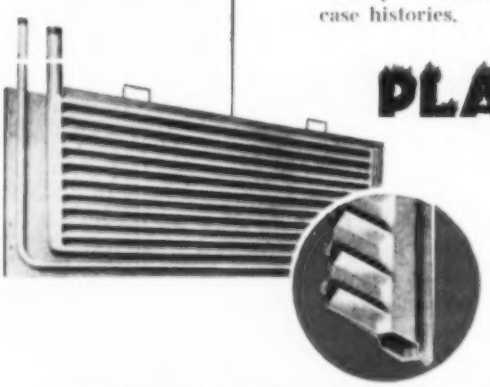
It costs less to cure coil-itis with Platecoils than to suffer its evils.

Write for Bulletin P78 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS REQUIRE 90% LESS CLEANING

At Motor Wheel Corporation cleaning time has been cut from 10 hours per pipe coil every 60 days to only one hour per Platecoil. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

*

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, TRANTER MANUFACTURING, Inc., LANSING 4, MICHIGAN

since 1932, has been general sales manager since 1948 and was appointed to the board of directors of the Tubular Products division in September, 1952.

Utnehmer joined Babcock & Wilcox in 1945 and has been works manager at Beaver Falls since 1948.

Johnston Pump Promotes Lundie To President of Subsidiaries

Kenneth G. Lundie, vice president in charge of sales for Johnston Pump Company of Pasadena, Calif., has been elected president of Johnston Pump Company of New Mexico and Johnston Pump Company of Fresno.

Lundie

Lundie has been associated for many years with the pump industry. For over 35 years he has been active in such fields as merchandising, sales promotion, sales management, and distribution of pumps. The two companies which he will head assemble, distribute, service, repair and maintain pumps for agriculture, industry and water supply.

Bristol Transfers Nuber to Instrument Division Position

Ernest Nuber has been appointed sales manager, Instrument division, of The Bristol Company, Waterbury, Conn.

Nuber

Nuber joined the Bristol sales engineering organization in 1929. He was made Pacific Coast manager in 1934 and later served for several years as Export manager. In 1948 he was promoted to manager, Application Engineering department. Nuber will continue to maintain his headquarters at the company's main office at Waterbury.

Sherwin-Williams Building Two New Plants in Latin America

Construction of new Sherwin-Williams Company plants in Venezuela and Mexico has been announced. The new plant in Mexico will reportedly double the company's production in that country. The Venezuelan plant at Valencia is being built in cooperation with Eugenio Mendoza & Cia., and will be headed by Walter Spencer of Sherwin-Williams. Although completion dates for the new plants have not been definitely set, construction is progressing rapidly. Both the Mexico City and Venezuelan facilities are expected to be in production this fall.

Clark Moves to Atlanta

John J. Shand, Southeastern regional sales manager of Clark Equipment Company, has moved his headquarters from Norfolk, Va., to 161 Spring Street Building, Atlanta, Ga.

Two Promotions, Two Autonomous Units Announced by Diamond Alkali

W. H. McConnell, director of sales, has been elected vice president—sales

McConnell

Lyon

and C. E. Lyon, works manager of the electrochemical plant at Houston, has been elected a vice president of Diamond Alkali Company.

Two new autonomous divisions have been formed, the Plastics and Agricultural Chemicals division with A. L. Geisinger, a vice president, as general manager; and the Chromium Chemicals division with Frank W. Jarvis as general manager. Jarvis since 1951 has been president of Diamond Magnesium Company, a subsidiary of Diamond Alkali.

McConnell joined Diamond in 1928. In 1931 became a salesman with Benner Chemical Company, then Diamond's sales outlet for Chicago and the midwest. He subsequently became vice president and sales manager of Benner, and in 1946 director of sales for Diamond.

From 1919 until 1931, Lyon was with the Hooker Electrochemical Company. He then joined Diamond for a four-year period before going with Niagara Alkali Company, where he was assistant superintendent of production. He resigned in 1941 to return to Diamond as head of the chlorine department. Five years later, when work was launched on the Houston plant, he was selected to head that operation.

Flexonics Brass Bellows Production Now in Memphis

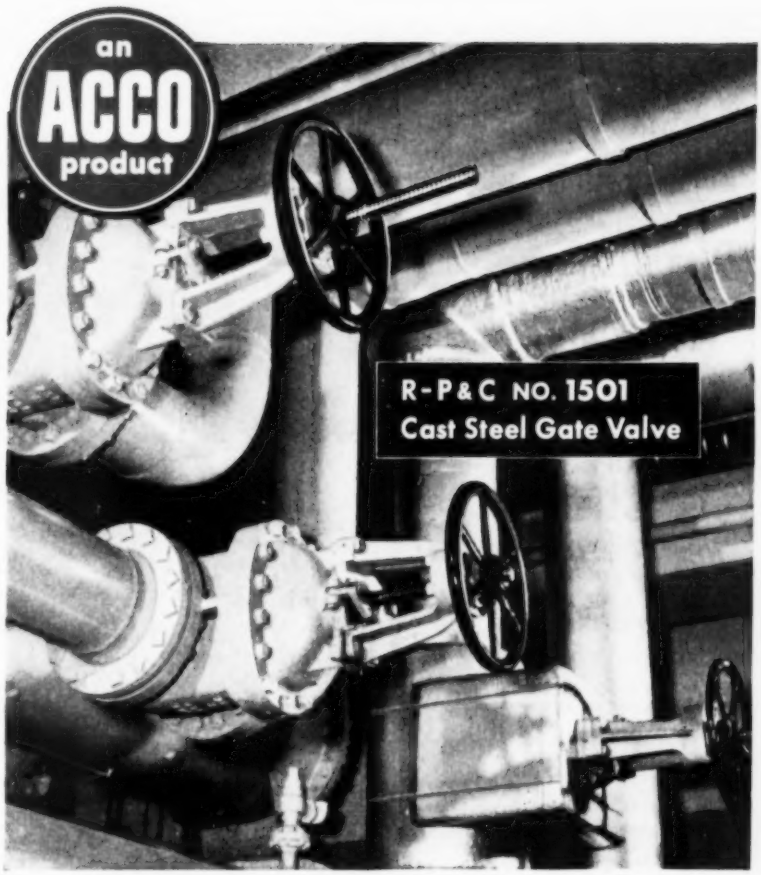
With completion in October of a 30,000-square-foot addition to its Memphis, Tenn., plant, Flexonics Corporation will transfer brass bellows production to Memphis from the pilot plant at Elgin, Illinois.

Output of brass bellows, widely used in valve seals and various types of thermostatic and pressure controls, will be stepped up six times, President John F. P. Farrar said. The move climaxes seven years of research and development of the product, involving an expenditure in excess of $2,000,000. Flexonics Corporation was formerly known as Chicago Metal Hose Corporation.

Norman Dawson, who has been quality control manager at Elgin, becomes superintendent of the Brass Bellows division at Memphis. Frank Brence continues as Memphis factory manager.

John Pugh Named to Handle Advertising for Axelson

John H. Pugh has been appointed director of advertising and public relations for the Axelson Manufacturing Company Division of Pressed Steel Car Company, Inc., Los Angeles. He has had consider-



How R-P&C Valves Reduce Maintenance Costs

• Six important features of R-P&C Cast Steel Valves eliminate many service troubles which in turn reduces maintenance costs.

First of all . . . they're made from electric furnace steel which means sound castings. All parts are designed for equal strength and great toughness. The bodies resist distortion. Permanent alignment is provided by the rigid one-piece yoke. And the gland packing stays tight even at high pressures and temperatures. Furthermore, the design detail assures smooth flow and positive shut-off.

You can get R-P&C Cast Steel Valves in gate, globe, angle, stop and check, and swing check types. Variety of trim metals for air, gas, liquid, oil, steam, water. Wide range of pressures and temperatures. Screwed, flanged, or welding ends. Sizes range from 1½" to 24".

Specify . . . and *get* . . . R-P&C Cast Steel Valves next time you order.

ACCO

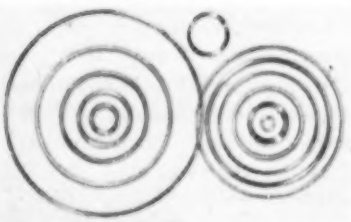
R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

Sand-Banum Sells
MORE POWER
from
LESS FUEL
with
FEWER SHUT-DOWNS
SAND-BANUM
Pure Colloidal Concentrate
Safely and Surely
REMOVES and PREVENTS
BOILER SCALE
Like Nothing Else!
Be Curious
Ask Us for Proof
AMERICAN SAND-BANUM CO.
Established 1926
9 Rockefeller Plaza
New York 20, N.Y.

Need RING GASKETS?



Call CHICAGO-WILCOX for PROMPT SERVICE
Since 1906, Chicago-Wilcox has served the refining industry with gaskets for every requirement. These A.P.I. ring gaskets are typical. Used on ring-type flanged joints in high pressure lines. Made of soft iron, standard steel alloys or any of the non-ferrous metals to any desired cross section.
Send specifications for quotations and prompt-delivery schedule.
CHICAGO-WILCOX MFG. CO.
7703 Avalon Avenue, Chicago 19, Ill.
Phone: SAginaw 1-1900
See Page 254 in Refinery Catalog

able advertising agency experience and more recently served as a psychological warfare officer, U. S. Army.

Lundy Appointed Assistant Sales Manager of Peerless Division

Everett W. Lundy has been named assistant sales manager, Peerless Pump Division, Food Machinery and Chemical Corporation, Los Angeles. Lundy, previously Pacific district manager for the pump firm, will be succeeded by Robert H. Hull, presently Peerless' Central district manager at Indianapolis. Hull, in turn, will be succeeded by Waldo T. Harman, Peerless' Chicago branch office manager. All appointments were effective September 1, 1953.

Lundy

Hull

Harman

Since graduation in 1925 Lundy has been identified in sales work with various manufacturers of engineered products, associating himself with the Peerless Pump organization in 1940.

Akers, Fawcett and Terry Elected To New Dominion Brake Shoe Posts

Dominion Brake Shoe Company, a subsidiary of American Brake Shoe Company, has elected Thomas F. Akers chairman, Kenneth T. Fawcett, president, and Maynard B. Terry vice president.

Formerly president of the Canadian company, Akers has more than 50 years of service. He held various positions in sales and supervision until appointed president in 1951. As chairman, he succeeds Maurice N. Trainer, who continues as president of the parent company.

Fawcett, formerly vice president of Dominion Brake Shoe, joined the Company in 1934. Terry, who is also president of the American Brakeblok division of the Company, joined American Brake Shoe in 1943.

Taylor Instrument Makes Changes In Industrial Sales Assignments

Three changes in its industrial sales staff have been announced by Taylor Instrument Companies of Rochester, N. Y.

Assigned to the New York office was Rudolf E. Leeds, formerly with the Instrument department of a New York engineering firm.

Assigned to new territories under the Tulsa office as industrial sales representatives were Byron W. Larsen, who will make his headquarters in New Orleans, and Lloyd Bell, who will work a territory centering around Amarillo, Texas.

Graver Tank Promotes Behmer to Chicago District Sales Manager

Graver Tank & Manufacturing Company, Inc., has promoted William C. Behmer to district sales manager at Chicago.

Joining the company in 1937, Behmer spent more than 15 years with Graver's sales department. Until 1946 he was headquartered at Graver's plant at East Chicago, when he was transferred to the company's office in Chicago. In 1951 he was named assistant sales manager for the Chicago district.

Behmer

Active in engineering circles, Behmer is a registered professional engineer in Illinois.

Columbia-Southern Chemical Reassigns Executive Personnel

Changes in executive personnel and a change in location of its Technical Service department from Barberton, Ohio, to Pittsburgh have been announced by Columbia-Southern Chemical Corporation. Columbia-Southern is a subsidiary of Pittsburgh Plate Glass Company.

E. W. Haley, director of sales, Pittsburgh, has been named assistant to the vice president. With headquarters in New York, he will handle the company's export sales program and special assignments from the vice president.

C. F. Bingham, assistant director of sales, has been named director of sales, with headquarters in Pittsburgh. C. J. Stroemple, acting manager of Calcium Hypochlorite sales, has been named assistant to the manager, Market Research and Development department. Foster G. Garrison, technical representative, Market Research and Development, has also been named assistant to the manager. Stroemple will be concerned with product development, Garrison with market research. Also in this department, Keith S. Potts has been named statistician.

L. C. Bell has been transferred from the Plant Development department to Sales, Calcium Hypochlorite department.

Other sales changes include:

T. R. Rudolf, from Dallas, Texas, district office to New Orleans as district sales manager; R. R. Blair, from Pigment Sales in the Chicago district to General Sales, Boston; John B. Harris, from student salesman at Barberton to salesman in Cleveland district territory.

Vernon Tool Will Manufacture And Sell Greenwood Valve Line

The Vernon Tool Co., Ltd., Alhambra, Calif., and D. H. Greenwood, valve engineer, have recently completed a contract whereby Vernon Tool becomes the exclusive licensee for the manufacture and sale of Greenwood Valves.

The Greenwood line, including the triple action quick closing safety valve, the vertical swing horizontal check valve, the unitized by-pass check valve, and the newly introduced gate valve line blind, will be operated as the Greenwood Valve Division of Vernon Tool.

John Walker, sales engineer, is being transferred to Vernon Tool's Houston offices to assist in introducing the line in the Mid-Continent and Gulf Coast areas.

Bailey Meter Promotes Gorrie to Head of Engineering Activities

H. H. Gorrie, assistant chief engineer of Bailey Meter Company, has been appointed chief engineer, directly in charge of the company's engineering activities.

Gorrie

A graduate of Rensselaer Polytechnic Institute, Gorrie started with the Bailey Meter organization in 1927. He became assistant chief engineer in 1944.

He is a registered professional engineer in Ohio and is active in several technical organizations.

Mayes Named General Manager of New G-E Small Motor Department

General Electric Company's Industrial Power Components division has established a Small Integral Motor department and has appointed Thorn L. Mayes general manager. The new department will be responsible for standard and derivative lines of polyphase induction motors from 1 to 5 horsepower. This will be the initial step in transferring the small integral motor business from the G-E Motor and Generator division. However, until the fall of 1953, only pilot plant manufacturing will take place at the new location in Fort Wayne, Ind., it was reported by the division.

In concurrent moves, the new general manager named four staff members of the new department: L. Dean Fowler, manager of marketing; Oscar L. Weitzman, manufacturing and employe relations; J. Herbert Behm, manager of engineering; and Martin L. Kresge, manager of finance.

Mayes, the new general manager, was manager of engineering at the G-E Lynn, Mass., motor factory before going to Fort Wayne last year. He joined General Electric in 1927.

Fowler, who joined General Electric in 1923, was named manager of marketing for the Control department in 1950, going to Fort Wayne last year as a consultant.

Weitzman, with G-E since 1906, also joined Mayes' staff as a consultant last year.

Behm returned to Fort Wayne in 1952 after a two-year assignment in Lynn, where he was assistant to the manager of engineering of Lynn motors. He joined the company in 1929.

Kresge has been with General Electric since 1941. Prior to his recent appointment he was a consultant on Mayes' staff at Fort Wayne.

GUNITE
Since 1915
CONCRETE
SAND AND CEMENT
"Placed by Air"

38 YEARS OF SERVICE TO AMERICAN GOVERNMENT and INDUSTRY

- Linings
- Encasing
- Fire Proofing
- Insulating
- Repairing
- New Construction
- Renovating
- Redevelopment

Send for specifications and bulletins—no obligation.
See our catalog in Sweets

GUNITE CONCRETE & CONST. CO.
ENGINEERS — CONTRACTORS
1301 WOODSWETHER RD., KANSAS CITY, MO.
CHICAGO — ST. LOUIS — MINNEAPOLIS
DENVER — HOUSTON — NEW ORLEANS

Rockwell Manufacturing Names Two Assistant Controllers

W. L. Neely, tax supervisor of Rockwell Manufacturing Company, and John T. Farrell, supervisor of the firm's headquarters accounting department, have been appointed assistant controllers.

Farrell has been with the company seven years, Neely, five. Neely was appointed tax supervisor a year ago after serving four years as division accountant for the company's Nordstrom Valve division in Oakland, Calif.

Rejoins Pennsalt's Corrosion Unit

James H. Cogshall has rejoined the Pennsylvania Salt Manufacturing Company as a sales engineer in the Corro-

PETROLEUM REFINER Classified Ads

RATES: Regular Classified (undisplayed) set in this size type; 10 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Display ads,** set in suitably larger type with ruled border, $10 per column inch.

All classified ads payable in advance. Ten percent discount for two or more insertions of same copy in consecutive issues. COPY DEADLINE: 25th of month preceding date of issue; Send copy and remittance to: Classified Ad Department, Petroleum Refiner, P. O. Box 2608, Houston, Texas.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

HELP WANTED

EQUIPMENT INSPECTION ENGINEERS
SOUTH AMERICA

A major oil company affiliated with Standard Oil Company (N.J.) needs graduate engineers with several years refinery process equipment inspection experience. Must be qualified to interpret codes and specifications, predict equipment renewals, and recommend replacement equipment. Write, giving age, marital status, education, and full details of experience.

Box 308-K
Radio City Station
New York 19, N. Y.

SITUATIONS WANTED

Chemical engineer experienced in heavy chemicals and petrochemicals, 7 years production, 6 years development and pilot plant operation, 2 years industrial waste disposal, 5 years army technical advisor. Location immaterial. Available immediately. Box 166-R, c/o Petroleum REFINER, Houston, Texas.

HELP WANTED

CHEMICAL ENGINEER OR PETROLEUM REFINING ENGINEER

The research and engineering department of a large chemical company has an opening for an engineer with five years of refinery experience in technical service to the manufacturing operation or as a process engineer on operating units in a large refinery. To have sole responsibility for planning and directing gasoline antiknock quality evaluation programs and make technoeconomic studies of refinery processes. Submit complete resume.

Box 165-R, c/o Petroleum Refiner
Houston, Texas

Senior Staff Mechanical Engineer

Permanent, challenging position on our staff for a graduate Mechanical Engineer with 10 years experience in Petroleum, Chemical, Power or allied fields of plant design. Our organization has an international reputation and is located on the East Coast. The man we seek must be capable of responsibility for overall arrangement, as well as selection and/or design of the principal components of process plants. Our salary offer is high, and in addition we have a liberal pension plan, accumulative vacation policy, executive insurance and other benefits. We will pay for your traveling and moving expenses. Write stating age, experience, background, salary history and your present salary requirements. Our staff knows of this opening and we will treat all replies confidentially. Box 167-R.

FOR SALE

• FOR SALE—A complete Waukesha laboratory aviation supercharge test engine, ASTM designation D909-47T (3C), with adequate spare parts. Excellent condition. Substantial price saving. R. H. Armstrong, Republic Oil Refining Company, Texas City, Texas.

GLASSES & GASKETS
MAGNIFYING
ALL SIZES TO FIT YOUR GAGES & VALVES
ERNST WATER COLUMN & GAGE CO.
Send for Catalog, LIVINGSTON, N. J.

Give yourself the

Unbeatable Performance of the RIDGID Heavy-Duty Pipe Wrench

If this Housing ever Breaks or Distorts we will replace it Free
RIDGID
HEAVY DUTY
14
"RIDGID" means most service for your money!

Every RIDGID Wrench Factory-Tested

That's what makes sure that every RIDGID performs as you've learned to expect... *every* part inspected; *every* wrench pipe tested 100%! Only RIDGID's housing is unconditionally guaranteed, saving you bother and expense. Full-floating hookjaw, adjusting nut spins easily in all sizes, 6" to 60"; replaceable alloy jaws, handy pipe scale on hookjaw, comfort-grip I-beam handle. For most service for your money, buy RIDGID's . . . at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

sion Engineering Products department in Philadelphia. Before being called to the Navy in 1951, Cogshall served as a corrosion engineer at Pennsalt's Wyandotte, Mich., plant, where he supervised a study of the use of protective coatings.

MacKenna Named Tulsa Manager For Worthington Corporation

L. J. MacKenna has been appointed district office manager of Worthington Corporation's Tulsa office according to an announcement by T. J. Kehane, assistant vice president and general sales manager.

MacKenna

MacKenna, who has been associated with the company's New York district sales office for the past 20 years, joined Worthington in July, 1926, after graduating from Northeastern University with a degree of B.S.M.E. He has served at East Cambridge, Mass., Harrison, N. J. and Detroit in addition to New York.

George Cook III Named Export Manager of Fiberglas Company

George Cook, III, has been named manager of the Export division of Owens-Corning Fiberglas Corporation.

Cook

Cook joined Owens-Corning in 1948 as a sales trainee after graduation from Yale University, and subsequently served as a salesman in Baltimore and New York City. In January of this year he was placed in charge of the corporation's recruiting program with his headquarters in Toledo.

A native of Baltimore, Mr. Cook served three years in the U. S. Army during World War II including duty in Italy with the Fifth Army.

R-S Furnace Announces Incorporation

The furnace division of R-S Products Corporation has incorporated, and will be known as R-S Furnace Corporation, a subsidiary of Hardinge Company, Incorporated.

The new corporation will maintain its sales and engineering offices at the same address as formerly—4555 Germantown Avenue, Philadelphia 44, Pennsylvania. Personnel will remain unchanged. D. E. Wyman will continue as vice president, S. M. Stoler as his assistant and F. L. Feldmeth as chief engineer.

ACF Promotes Milo Millette to Works Manager at Buffalo Plant

M. Milo Millette, who has been acting head of American Car and Foundry Company's Buffalo, N. Y., plant since February, has been appointed works manager of the plant. He will be in charge of all engineering and production which ACF is performing for U. S. government agencies.

Whitford Named Ansul Chairman, Mars Research Vice President

A. J. Whitford, president of the First National Bank of Marinette, Wis., has been elected chairman of the board of Ansul Chemical Company of Marinette. He succeeds Harvey V. Higley, who was appointed recently, Director of the Veterans Administration. Higley will continue to serve Ansul as a director, without salary.

Mars

Ansul also has named C. Victor Mars vice president in charge of research and development. Mars' 22-year career with Ansul includes service as a research chemist, refrigeration and industrial chemicals salesman, manager of product development and director of research and development.

Cooper-Bessemer Adds Moore to Chicago Office as Sales Engineer

R. L. Moore has been appointed sales engineer in The Cooper-Bessemer Corporation's Chicago office. At the Chicago office, he will devote his efforts to the engineering and sales of diesel and gas engines, air and gas compressors for manufacturing and chemical operations in the Midwest.

Moore

For the last several years, Moore has been engineering the application of compressors to essentially every type of industry.

Four Promoted by Timken As Lilley Replaces Eppler

Four promotions in the steel and tube division sales, The Timken Roller Bearing Company, Canton, Ohio, have been announced as follows:

Harry B. Lilley transferred from manager of the division's office in Houston to manager of the division's district office, Detroit. Lilley replaces L. W. Eppler, resigned to start his own automotive parts manufacturing company.

John J. McGrann promoted from sales engineer to manager of the Houston office.

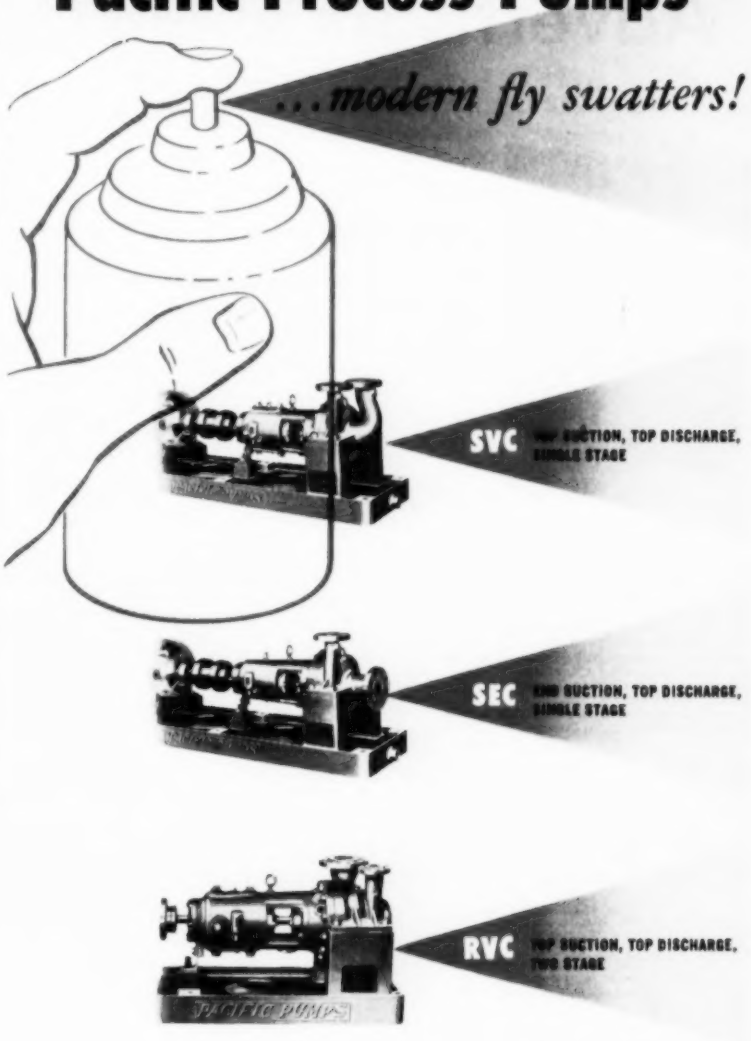
R. R. Hershey transferred to the Detroit office from Milwaukee where he was a sales engineer.

Succeeding Hershey is M. A. Conley, at present sales engineer in the district office at Cleveland.

Raybestos-Manhattan Ups Kuzmick

Joseph N. Kuzmick has been appointed coordinator, Corporation Research and Development by Raybestos-Manhattan, Inc. His duties will extend to all Divisions of the Corporation and he will headquarter at Passaic, N. J. Mr. Kuzmick has been with the Manhattan Rubber Division for more than 30 years.

Pacific Process Pumps



★ Custom fabricated from properly chosen materials to perform their tough jobs, Pacific process pumps give a mighty assist in the production of insect sprays, detergents, antiseptics and a host of other products that safeguard health and give comfort to mankind . . . thus in a sense becoming "modern fly swatters." The widespread use of Pacific process pumps for heavy-duty assignments in the petro-chemical industry is conclusive proof of Pacific's ability to perform continuous service with sustained economy.

Pacific single-stage Types SVC and SEC handle liquids from sub-zero to 800°F., 15 to 1,600 gpm, 500 to 600 psig, discharge pressure, differential heads up to 600 feet, speeds to 4,000 rpm. Two-stage Type RVC pumps liquids from sub-zero to 850°F., 50 to 600 gpm, discharge pressure to 600 psig, differential heads to 825 feet, speeds to 3,600 rpm. For further details, write for Bulletins 101 and 108.

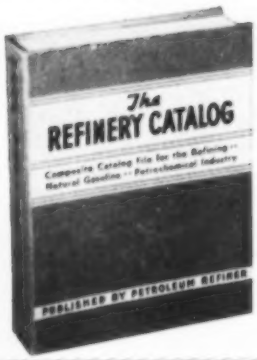
PACIFIC Precision Built PUMPS

Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities

CP-9

Advertisers in the October Issue



They're in The Refinery Catalog

*** The asterisk preceding name of advertiser indicates that detailed data on products and services of the firm will be found in The 1953 Refinery Catalog.**

A

*The Air Preheater Corp. 52
*Airetool Manufacturing Co. 222
Alan Wood Steel Co. 174, 234
*Allis-Chalmers Manufacturing Co. 7, 9, 11
*Aluminum Company of America 75
*American Locomotive Co. 66-67
American Machine and Metals, Inc. 65
*American Recording Chart Co. 251
American Sand-Banum Company 238
Atlantic Refining Co. 68-69
Atlas Powder Co. 58
Austin Brothers Steel Co. 233

B

*The Babcock & Wilcox Co. 28-29, 181
*Badger Manufacturing Co. 179, 236
*Baldwin-Hill Company 224
The J. H. Beaird Co. Insert 64-65
*Blaw-Knox Company 17, 169, 255
*Bridgeport Brass Co. 171
Brown & Root, Inc. 94
Burgess-Manning Company 209

C

*Calumet & Hecla, Inc. 79
Catawissa Valve & Fittings Co. 177
Central Scientific Co. 232
The Chapman Valve Manufacturing Co. 203
Chemical Construction Corp. 215
Chemical Industries Exposition 246
Chicago Bridge & Iron Co. 204
*Chicago-Wilcox Mfg. Co. 258
*Chiksan Company 82
*Childers Manufacturing Co. 10
Cities Service Co. 195
Clark Equipment Co. 167
Classified Ads 259
Cleton, Ltd. 253
*The Continental Supply Co. IV Cover
*Crane Company 163
*Croll-Reynolds Co. 242
*Crouse-Hinds Co. 30
W. H. Curtin & Co. 252

D

Dean Brothers Pumps Inc. 186
De Laval Steam Turbine Co. 199
Dempster Brothers, Inc. 196
John Dollinger, Jr., Inc. 250
Dowell Inc. 192
*Dresser Industries, Inc. 183, 261
E. I. du Pont de Nemours & Co. 90, Insert 168-169
*The Duraloy Co. 230
*Durametallic Corp. 238

E

*The Eagle-Picher Co. 200
*Elliott Company 53, 161
Engineering Corporation of America 254
Ethyl Corp. Insert 16-17

F

*Farris Engineering Corp. 78
Fenwal, Inc. 225
Filtrol Corp. 229
Fischer & Porter Co. Opp. 32
*Flexonics Corp. 182
*Food Machinery & Chemical Corp. 12
*Foster Wheeler Corp. 227
The Foxboro Company 62
Fractionating Towers, Inc. 250
Frontier Industries, Inc. 226

G

*General Electric Co. 76-77
A. P. Green Fire Brick Co. 81
*Grinnell Company 13
Gunite Concrete and Construction Co. 259

H

*Hartzell Propeller Fan Co. 264
*Howe-Baker Corp. Opp. 96
*Hudson Engineering Corp. 183-185
Hydrocarbon Research, Inc. Opp. 33

I

*Ingersoll-Rand Co. 49
*Insul-Mastic Corp. of America 19
International Exposition Co. 246
The International Nickel Co. 33, 166

J

*The C. O. Jelliff Mfg. Co. 242
Jet-Lube, Inc. 252
*Johns-Manville Corp. 175

K

*Keasbey & Mattison Co. 247
*The M. W. Kellogg Co. Insert 232-233
The C. M. Kemp Mfg. Co. 56
Wm. Kenyon & Sons, Ltd. 242
Kinney Manufacturing Co. 255
*Koch Engineering Co. 72
Koppers Company 178

L

Larkin Packer Co. 241
Layne & Bowler, Inc. 25
Leeds & Northrup Co. 8
Warner Lewis Co. 253
Lubbock Machine & Supply Co., Inc. 180
*The Lummus Company 80

M

Manning, Maxwell & Moore, Inc. 188
*Manzel Division of Frontier Industries, Inc. 226
*Mason-Neilan Regulator Co. 34-35
The Master Electric Co. 40
*Arthur G. McKee & Co. 165
*Metal Goods Corp. 50
*Milton Roy Co. 45
*Mine Safety Appliances Co. Opp. 97
Minneapolis-Honeywell Regulator Co. 36-37, 84-85, 245
Mission Manufacturing Co. 57
*Mixing Equipment Co. 88
*Murray Iron Works Co. 184

N

Nagle Pumps, Inc. 238
*National Airoil Burner Co. 254
National Can Corp. 46
Natural Gas Equipment, Inc. 168
Newport News Shipbuilding & Dry Dock Co. 61
The New York Air Brake Co. 83
*Niagara Filter Division American Machine & Metals, Inc. 65
*W. H. Nicholson & Co. 54
Norton Company 20-21

O

*Oakite Products, Inc. 235
*Orbit Valve Co. 237

P

Pacific Coast Borax Co. 240
*Pacific Pumps, Inc. 261
Pacific Tube Co. 5
Page Steel & Wire Division American Chain & Cable Co. 248
*Palmer Thermometers, Inc. 243
The Patterson Foundry & Machine Co. 249
*Peerless Pump Division Food Machinery & Chemical Corp. 12
Perco Division Phillips Petroleum Co. 24
*Petro-Chem Development Co. 51
*Petroleum Refiner 231
Philadelphia Gear Works, Inc. 4
Phillips Petroleum Co. 24
Platecoil Division Tranter Manufacturing Co., Inc. 256
H. K. Porter Co. 87
The Wm. Powell Co. 23
*The Pressed Steel Co. 32
*J. F. Pritchard & Co. 252, 263
Procon Incorporated 38-39
*Pyrene Manufacturing Co. 185

Q

The Quaker Oats Co. 55

R

Reading-Pratt & Cady Division American Chain & Cable Co. 257
*The Refinery Engineering Co. 42
Refinery Supply Co. 232
*Republic Steel Corp. 73
*Revere Copper and Brass Inc. 159
*The Ridge Tool Co. 172, 260
*Rochester Manufacturing Co. 241
*Rockwell Manufacturing Co. 26-27
*Rockwell Sprinkler Co. 31, 207
*Roots-Connersville Blower Corp. 183

S

Sawyer-Jensen-Ross Co. 246
Schield Bantam Co. 221
Schutte & Koerting Co. 41
*Scovill Manufacturing Co. 60
Shell Oil Company 223
Sims Pump Valve Co. 242
Southern Engine & Pump Co. 235
Sparkler Manufacturing Co. 240
*Spring Packing Corp. 63
*Stratford Engineering Corp. 74
*Struthers Wells Corp. 86
*Sun Shipbuilding & Dry Dock Co. 191

T

*Taylor Instrument Companies 18
*The Terry Steam Turbine Co. 48
Texas Employers Insurance Assoc. 43
Thermo Electric Co. 64
The Timken Roller Bearing Co. 6
Tracerlab Inc. 213
Tranter Manufacturing, Inc. 256

U

United States Gasket Co. 249
*United States Rubber Co. 70-71
*United States Steel Corp. 218
*Universal Atlas Cement Co. 218

V

*Vernon Tool Co. 235
*Henry Vogt Machine Co. 44
J. H. H. Voss Co. 170

W

W-K-M Company 173
Walworth Company 47
Warren Petroleum Corp. I Cover
*Watson-Stillman Fittings Division H. K. Porter Co., Inc. 87
*Western Supply Co. 187
*Weston Electrical Instrument Corp. 220
Whitmor Homebuilders, Inc. 22
*Wolverine Tube Division Calumet & Hecla, Inc. 79
*Worthington Corp. 14-15, 16
Wyatt Metal & Boiler Works III Cover

Y

*Yarnall-Waring Co. II Cover
*Otto H. York Co. 176

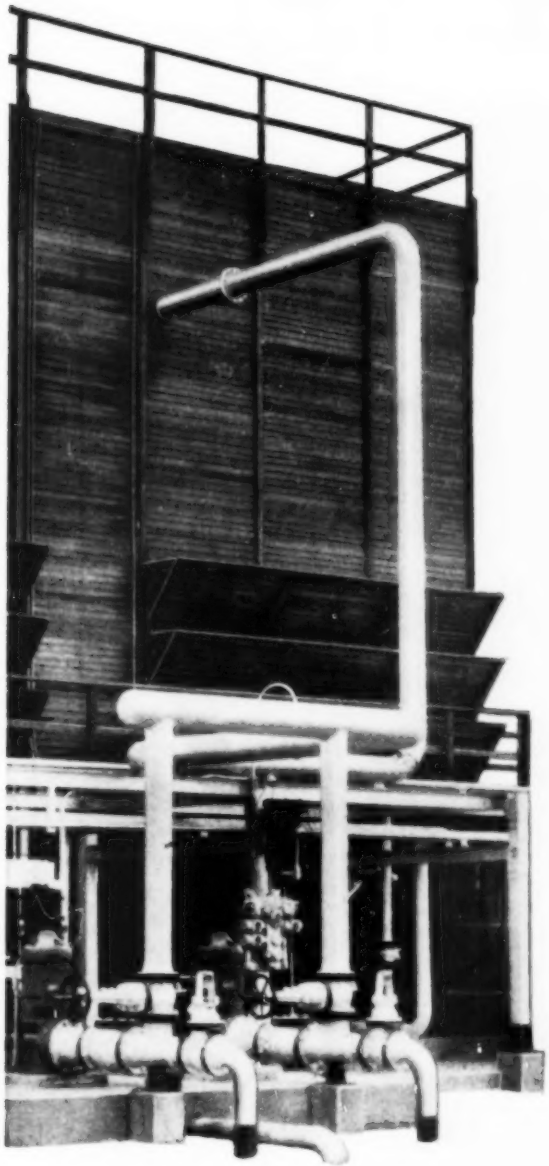
Z

*Zallea Brothers 59

Use the Postcards

Quick—Easy

YOU KNOW YOU'RE RIGHT!



Men in the petro-chemical industry who specify Pritchard cooling towers have the satisfaction of knowing they have made the right decision.

How do they know? First, Pritchard experts consult with them on exactly what is needed for the specific cooling job. Then, experienced Pritchard engineers help them select the right tower for that job . . . the unit with the proper capacity and design for efficient operation . . . maximum water-saving. Finally these men know they can depend on Pritchard to deliver such a tower because of Pritchard's acknowledged reputation for building reliable, rugged, quality units and the unconditional guarantee that Pritchard towers will perform as specified.

You'll know you're right, too, when you consult Pritchard—a founder member of the Cooling Tower Institute—about your cooling needs. Look in the classified section of your telephone directory for your nearest Pritchard representative or write direct to Pritchard's General Offices, Kansas City, Missouri.

You're right again when you specify a Pritchard QUINTAIR* *air-cooled heat exchanger for dependable, efficient cooling or condensing of liquids, gases or vapors. Quality construction assures long, trouble-free service . . . skillful design makes all parts that may require attention readily accessible for easy maintenance.*

**Registered Trade Name*

Industry's Partner for Progress

Cooling Towers
Specialized Heat Exchangers
Gas and Air Treating Equipment
Construction and Processing Facilities

J.F. Pritchard & Co.

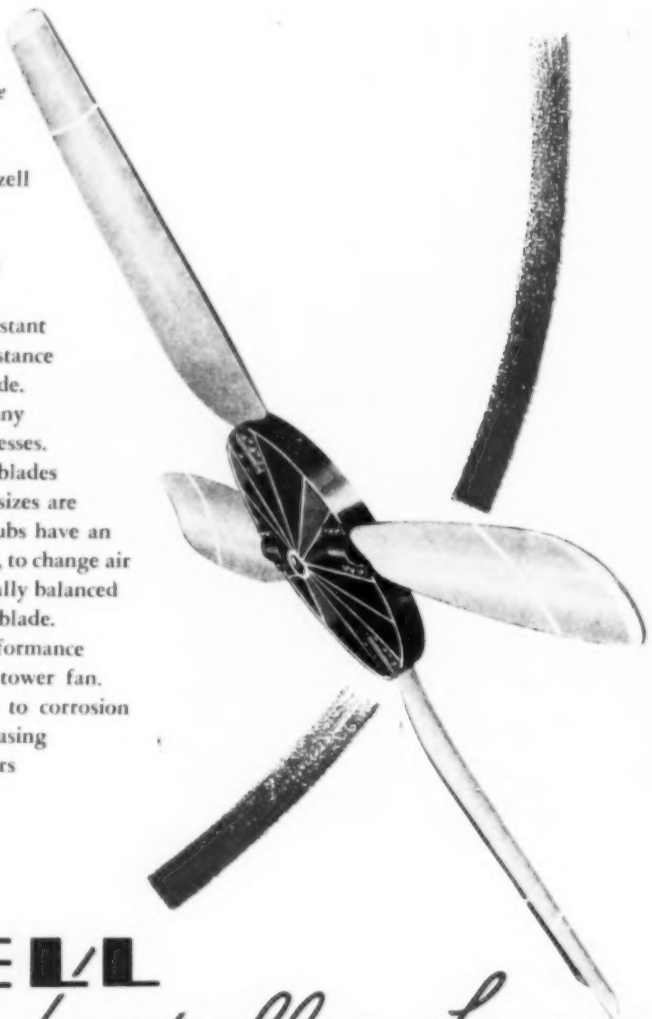
ENGINEERS • CONSTRUCTORS • MANUFACTURERS

Dept. 324 210 West 10th Street, Kansas City 5, Mo.

DISTRICT OFFICES: CHICAGO • HOUSTON • NEW YORK
PITTSBURG • ST. LOUIS • TULSA

Representatives in Principal Cities from Coast to Coast

Why the Petroleum Industry Prefers HARTZELL Cooling Tower Fans



Nearly every Hartzell cooling tower fan installed since the introduction of the Hartzite plastic blade in 1941 is still in service. This proven dependability explains why the plant which has had experience with one Hartzell fan will almost invariably insist on more Hartzells as other fans need replacement.

Fabric-base Hartzite plastic was developed especially to meet the rugged requirements of the petroleum industry. It is unusually resistant to corrosion and abrasion. Durability and resistance to corrosion are constant throughout the blade. Hartzite absorbs vibration. Its strength is many times that necessary to withstand normal stresses.

Hartzell cooling tower fans with Hartzite blades are available in sizes from 10′ to 22′. Smaller sizes are made of aluminum alloy. The welded steel hubs have an extremely high safety factor. Blade adjustment, to change air delivery, is easily made. All hubs are dynamically balanced and all blades are balanced against a master blade.

You no longer have to rely on claims. Performance has proven that Hartzell makes *the* cooling tower fan. Recognition of Hartzell's superior resistance to corrosion and mechanical damage is found in the increasing frequency with which cooling tower operators specify simply "Hartzell fan."

Send for Bulletin 1503.

HARTZELL *propeller fan co.*

Div. of Castle Hills Corp.

Dept. R

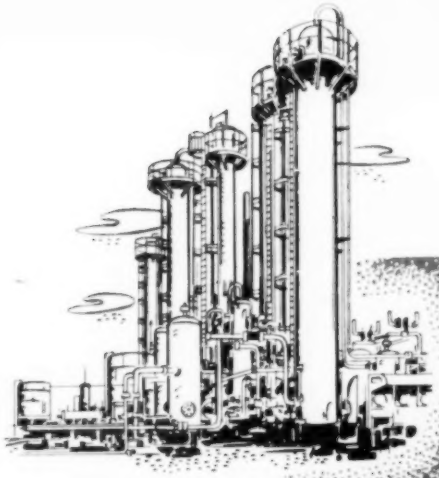
PIQUA, OHIO

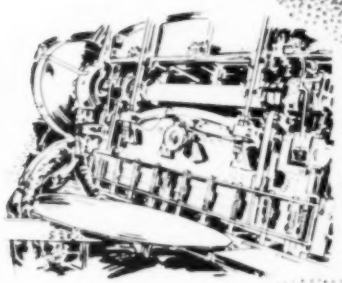
PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

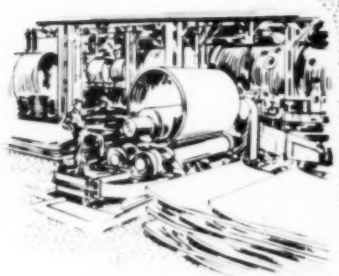
ENGINEERING OFFICES IN PRINCIPAL CITIES

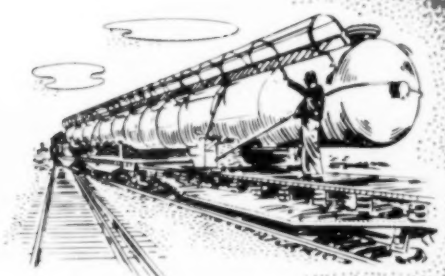
Name _____
Company _____
Street & Number _____
City & State _____
If student, check here for special information ☐

BEHIND THESE PRODUCTS..









. . are 40 years of Continuous Advancement in Fabrication

● Operating under a code of strict compliance to every specification, Wyatt Metal & Boiler Works is fully able to fulfill the most exacting requirements of any job, any size.

Forty Years of continuous advancement and expansion finds Wyatt's capable of shouldering all responsibilities for the satisfactory completion and erection of your work.

Wyatt's

HOUSTON-DALLAS-NEW YORK-TULSA

MANUFACTURERS AND ERECTORS SINCE 1913

Covering the REFINING Industry

YOU CAN COUNT ON CONTINENTAL

for Quality and Service

Experienced engineers and service specialists,
offering equipment and supplies of proved *quality*.
That's what you get when you count on Continental.

CONTINENTAL

SERVING THE OIL AND GAS INDUSTRIES

THE CONTINENTAL SUPPLY COMPANY
General Offices: DALLAS, TEXAS
Representatives in All Principal Oil Fields of the World